

STATE OF FLORIDA

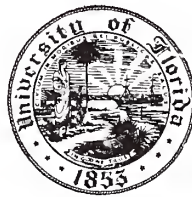
**SOLID WASTE MANAGEMENT
AND
RESOURCE RECOVERY
TECHNICAL ASSISTANCE
HANDBOOK**

**DEPARTMENT OF
ENVIRONMENTAL REGULATION
TALLAHASSEE, FLORIDA**

OCTOBER, 1976

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SOLID WASTE MANAGEMENT

AND

RESOURCE RECOVERY

TECHNICAL ASSISTANCE HANDBOOK



FLORIDA DEPARTMENT OF ENVIRONMENTAL REGULATION

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PREFACE

On June 30, 1976, the Florida Environmental Regulation Commission adopted Chapter 17-7 Part II, Florida Administrative Code, which became a rule of the Department of Environmental Regulation. The rule is required by Chapter 403.705, Florida Statutes, enacted by the State Legislature, June, 1974. The Department Rule is the State Resource Recovery and Management Program. It contains guidelines for, and responsibilities of, local governments to implement their own local resource recovery and management programs. Such programs are to provide for the orderly storage, collection, transportation, separation, processing, recovery, recycling, and disposal of solid waste.

Because Resource Recovery and Management means total solid waste management, and because it has been adopted as a State Rule, the "Solid Waste Management Plan for Florida," published in 1971 by the Department of Health and Rehabilitative Services and subsequently reassigned to the Department of Environmental Regulation, is being replaced by this document.

This Solid Waste Management and Resource Recovery Technical Assistance Handbook provides suggestions that will aid counties and municipalities in Florida to develop their programs.

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March 1977

CONTENTS

	<u>Page</u>
Preface	i
Contents	ii
The Florida Resource Recovery Council	vii
Introduction	x
Chapter 1.0 - Principles and Objectives of the Solid Waste Management and Resource Recovery Program	1
Section 1.1 - Solid Waste Management Program Planning	1
1.2 - County, Municipal or Regional Programs	1
1.3 - Waste Generation	2
1.4 - Recovery of Materials and Energy	2
1.5 - Litter Control Programs	3
1.6 - Hazardous and Toxic Wastes	3
Chapter 2.0 - State Strategies for Solid Waste Management and Resource Recovery	4
Section 2.1 - Short Range Plan	4
2.2 - Long Range Plan	12
Chapter 3.0 - Suggested Outline for a Local Solid Waste Management and Resource Recovery Plan	17
Section 3.1 - Elements of the Plan	17
Chapter 4.0 - A Method for Developing a Local or Regional Plan	23
Section 4.1 - Application	23
4.2 - Coordination	24
4.3 - Basic Planning Model	24
4.4 - Base Studies	26

	<u>Page</u>
4.5 - Management Considerations	30
4.6 - Management Techniques	37
4.7 - Plan Implementation	38
Chapter 5.0 - Solid Waste Management Techniques	42
Section 5.1 - Storage	42
5.2 - Collection	43
5.3 - Transportation	64
Chapter 6.0 - Hazardous Wastes	66
Section 6.1 - Current Department of Environmental Environmental Regulation Policy	66
6.2 - Disposal	68
6.3 - Safety	68
Chapter 7.0 - Special Wastes	72
Section 7.1 - Abandoned Vehicles	72
7.2 - Agricultural Waste	72
7.3 - Dead Animals	73
7.4 - Industrial Waste	74
7.5 - Sludges	74
7.6 - Used Tires	75
7.7 - Waste Oil	75
7.8 - Bulky Items	76
Chapter 8.0 - Resource Recovery Systems for Solid Waste Management	78
Section 8.1 - General Considerations for Resource Recovery System Design	79
8.2 - Energy Recovery Systems	84

	<u>Page</u>
8.3 - Materials Recovery Systems	112
8.4 - Recommended Contract Conditions for a Resource Recovery Facility	127
8.5 - Community Recycling Centers	130
Chapter 9.0 - Public Financing	132
Section 9.1 - Revenues	132
9.2 - Borrowing	132
9.3 - Short and Medium Term Financing Alternatives	132
9.4 - Long Term Obligations	132
9.5 - General Obligation Bonds	133
9.6 - Revenue Bonds, General	134
9.7 - Florida State Revenue Bonds	136
9.8 - Industrial Revenue Bonds	139
9.10- Leveraged Leasing	140
9.11- Financial Consultants	142
9.12- Investment Banking Firms	143
9.13- Bond Counsel	143
9.14- Decision Making	143
Chapter 10.0- Sanitary Landfills	145
Section 10.1- Planning	145
10.2- Design	145
10.3- High Water Table Problems	146
10.4- Soils	148
10.5- General Method	149
10.6- Florida High Rise Method	149
10.7- Wetland Method	151

	<u>Page</u>
10.8 - Trench Method	151
10.9 - Design Outline	153
Chapter 11.0 - Disaster Plan	155
Section 11.1 - Mutual Aid Agreement	155
11.2 - Blockading Refuse	155
11.3 - Emergency Sites	156
Chapter 12.0 - Model Ordinance, Collection Contract, Intergovernmental Agreement	157
Section 12.1 - Model Ordinance	158
12.2 - Model Collection Contract	178
12.3 - Model Intergovernmental Agreement	189
Chapter 13.0 - Glossary	193

LIST OF TABLES

<u>TABLE</u>		<u>PAGE</u>
2-1	Designated Areas for Resource Recovery	8
5-1	Standard Industrial Classifications	45
5-2	Solid Waste Sources and Types	46
5-3	Types of Waste	47
5-4	Estimate Amounts of Solid Waste	49
5-5	Collection Costs	50
8-1	Material Flow Estimate of Residential and Commercial Post Consumer Solid Waste	81
8-2	Energy Recovery Technology and Products	87
8-3	Materials Recovery Systems Locations and Products	113

LIST OF FIGURES

<u>FIGURE</u>		<u>PAGE</u>
2-1	Summary Schedule	16
8-1	Idealized Solid Waste Cycle	77
8-2	Typical Waterwall Furnace for Unprocessed Solid Waste	86
8-3	General RDF Production Schematic	91
8-4	St. Louis RDF Preparation Facility	94
8-5	Wet Process Energy Recovery System	96
8-6	Union Carbide Purox System	101
8-7	Monsanto Landgard	103
8-8	Torrax Slagging Pyrolysis System	105
8-9	Production of Electricity from Landfill Gas	107

<u>FIGURE</u>		<u>PAGE</u>
8-10	Biological Gasification of Refuse in Reactors	109
8-11	Production of "Oil" from Solid Waste Using the Occidental Process	111
8-12	Wet Process Fiber Recovery System	115
8-13	Dry Process Paper and Materials Recovery	117
8-14	Magnetic Separator Configuration	120
8-15	Wet Process Glass Recovery System	123
8-16	"Dry Process" Materials Recovery	125
8-17	"Aluminum Magnet" Aluminum Recovery System	128
10-1	Annual Land Requirement	147
10-2	Annual Land Requirement	147
10-3	General Method for Sanitary Landfill	150
10-4	Florida High Rise Method Base Preparation	150
10-5	Illustration of High Rise Method	152
10-6	Illustration of Wetlands Method	152
10-7	Trench Method	154

THE FLORIDA RESOURCE RECOVERY COUNCIL

The Department Rule and this handbook were written with the cooperation and approval of the Florida Resource Recovery Council and incorporates many of their recommendations.

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Mr. George L. Stuart, Jr., Vice Chairman	City Commissioner City of Orlando
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INTRODUCTION

The Florida Resource Recovery and Management Act was enacted by the 1974 Legislature to establish and maintain a comprehensive State solid waste management and resource recovery program to plan for and regulate the storage, collection, transport, separation, processing, recycling and disposal of solid waste. The Legislature recognized that the increasing volume and variety of solid wastes being generated throughout the State, together with inefficient and improper methods of managing such wastes, create hazards to health, cause pollution of air and water resources, waste natural resources, have an adverse effect on land values and create public nuisances.

The legislation specifies that the primary responsibility for adequate solid waste management and planning shall rest with local government. Specifically, the Act provides the authority to and requires counties, municipalities or regions to adequately plan and provide efficient, environmentally acceptable resource recovery and management. The principal expression of this responsibility will be through the required solid waste management plans.

Chapter 17-7, Part II, Florida Administrative Code (Rule of the Department of Environmental Regulation), contains the guidelines and responsibility for counties and municipalities which are necessary to comply with the Act. This handbook has been prepared by the Department of Environmental Regulation to assist governmental agencies in the development of their local solid waste management programs. This publication contains recommendations which may or may not be appropriate to a particular location; therefore, local circumstances must dictate what method or technology may be useful.

Technologies described herein are not intended to be complete planning or engineering documents, but will serve to illustrate some of the solid waste management methods that can be applied to serve a community or county.

Chapters 1 and 2 that follow can be construed to represent the official solid waste management plan for the State since they basically set forth the goals the State hopes to accomplish in the foreseeable future.

1.0 PRINCIPLES AND OBJECTIVES OF THE STATE SOLID WASTE MANAGEMENT AND RESOURCE RECOVERY PROGRAM

The proper management of solid wastes in a manner which will protect public health and safety, protect the environment, preserve natural resources and provide for maximum recovery of resources contained therein, requires implementation of solid waste programs which will conform to the following principles:

- 1.1 PRINCIPLE: SOLID WASTE MANAGEMENT PROGRAMS WILL BE PLANNED TO PROVIDE FOR ADEQUATE SANITARY, SAFE AND ENVIRONMENTALLY SOUND SOLID WASTE STORAGE, COLLECTION, PROCESSING, DISPOSAL FACILITIES AND SERVICES TO MEET THE RESIDENTIAL, INSTITUTIONAL, COMMERCIAL, INDUSTRIAL AND AGRICULTURAL NEEDS OF THE STATE OF FLORIDA.

OBJECTIVES

- 1.1.1 Insure that counties and municipalities, either solely or in cooperation with other counties and municipalities or appropriate regional agencies, plan adequate solid waste storage, collection, processing, resource recovery or disposal facilities and services.
- 1.1.2 Monitor solid waste management plans to insure implementation according to a schedule developed by the local governmental jurisdiction.
- 1.1.3 Encourage citizen participation in development of solid waste management programs and plans, and to help citizen understanding of solid waste management problems and solutions.
- 1.1.4 Assure that solid waste management problems are approached on a scale sufficiently large to provide optimum economy and efficiency.
- 1.2 PRINCIPLE: COUNTY, MUNICIPAL OR REGIONAL SOLID WASTE MANAGEMENT PROGRAMS SHOULD COMPLEMENT EACH OTHER AND COMPLY WITH ALL APPLICABLE STATE STANDARDS.

OBJECTIVES

- 1.2.1 Assure that all proposed new solid waste facilities are consistent with county, municipal or regional solid waste management plans and are in conformance with requirements established by the Department of Environmental Regulation.

- 1.2.2 Where the private sector is utilized for solid waste management, the licensing of such services by local agencies should be based on assurance of the financial capability and the management experience of private firms to satisfactorily provide these services.
- 1.2.3 Encourage practical safety standards for protection of all personnel involved in solid waste collection, processing, disposal and resource recovery programs.
- 1.2.4 Encourage use of improved or new technology to achieve optimum management consistent with sound use of financial resources.
- 1.2.5 Provide technical assistance to government and private industry in disseminating the latest solid waste management technology and practices which promote conformance with State solid waste management policy, requirements and programs.
- 1.2.6 Encourage land use zoning which will protect solid waste management facilities and disposal sites from encroachment by noncompatible land uses.
- 1.3 PRINCIPLE: WASTE GENERATION SHOULD BE REDUCED TO PROMOTE AND ENHANCE CONSERVATION OF ENERGY, NATURAL RESOURCES AND LAND RESOURCES.

OBJECTIVES

- 1.3.1 Encourage private industries, State and local governments, and the public to implement source reduction practices to reduce waste generation.
- 1.3.2 Encourage federal action toward practical and economic approaches to national policies that provide for reduction in generation of waste materials.
- 1.3.3 Promote modification of products by industry to reduce the quantity of materials used or to facilitate materials recovery.
- 1.4 PRINCIPLE: RECOVERY OF MATERIALS AND ENERGY FROM SOLID WASTE SHOULD BE ENCOURAGED TO CONSERVE ENERGY, LAND AND NATURAL RESOURCES.

OBJECTIVES

- 1.4.1 Insure that designated resource recovery area plans have a resource recovery element. Plans should include an evaluation of the feasibility of resource recovery, working towards recovery of energy and materials.

- 1.4.2 Encourage investment of private capital along with local governments in the development of resource recovery systems.
 - 1.4.3 Provide information relative to resource recovery markets and technology.
 - 1.4.4 Encourage procurement and use of products containing secondary materials that meet standards and to work for elimination of discriminatory policies toward recovery, storage, transportation and use of secondary materials.
- 1.5 PRINCIPLE: LITTER CONTROL PROGRAMS FOR CLEANUP AND REDUCTION OF LITTER ARE ESSENTIAL TO THE ENVIRONMENTAL QUALITY OF FLORIDA AND TO THE HEALTH, SAFETY AND WELL-BEING OF THE PUBLIC.

OBJECTIVES

- 1.5.1 Promote State and local litter control programs and develop public awareness and citizen support through assistance and public information toward a solution of the litter problem.
 - 1.5.2 Encourage counties, municipalities and regions to include in their solid waste management plans a litter control program element providing for adoption, implementation and enforcement of litter control laws and regulations.
- 1.6 PRINCIPLE: HAZARDOUS AND TOXIC WASTES SHOULD BE COLLECTED, TRANSPORTED, TREATED AND DISPOSED IN A MANNER THAT WILL PROVIDE MAXIMUM PROTECTION OF THE PUBLIC AND ENVIRONMENT.

OBJECTIVES

- 1.6.1 Determine hazardous waste sources, types, quantities and current methods of treatment and disposal, and information about private collectors and transporters operating in the State.
- 1.6.2 Define hazardous waste for other agencies, local governments and other interested persons, pointing out what hazardous wastes are and the present status of hazardous waste management in Florida.
- 1.6.3 Designate or develop special hazardous waste facility locations based on generation-concentration, hydrogeologic considerations, economic and environmental criteria, and on the type of waste. Facilities operated by the private sector will be encouraged.
- 1.6.4 Develop proposed legislation for proper control, treatment and disposal of hazardous waste in Florida.

2.0 STATE STRATEGIES FOR SOLID WASTE MANAGEMENT AND RESOURCE RECOVERY

The following are specific actions which the Department of Environmental Regulation intends to pursue to implement the requirements of the Florida Resource Recovery and Management Act. In most cases, the Department currently has authority for implementation. Where it is lacking, necessary legislation will be sought to implement policy objectives.

2.1 Short Range Plan. Elements of this phase are now underway or are to be accomplished by 1980.

2.1.1 Elimination or improvement of all unsatisfactory solid waste disposal sites or facilities by July 1, 1977.

Effective January 1, 1975, all solid waste facilities are required to have a permit issued by the Department of Environmental Regulation (DER) in accordance with Chapter 17-7, Florida Administrative Code. Operation Permits are issued to all satisfactory sites. Temporary Operation Permits are issued to existing facilities that are unsatisfactory, but have potential to be improved to meet standards, or will be closed by July 1, 1977. As a condition for issuance, Temporary Operation Permits must include a compliance schedule which will be an incremental plan to improve or eliminate the unsatisfactory facility. Temporary Permits are not authorized after July 1, 1977.

During 1975, approximately 100 disposal sites (dumps) were closed by local governments in response to State requirements. The remaining 410 should decrease to 250 by 1980. The anticipated decrease will be caused by further elimination of sites by consolidation into centralized sanitary landfills or integration into resource recovery systems.

It is the plan of the Department of Environmental Regulation to reduce total dependence on conventional methods such as sanitary landfills and achieve maximum resource recovery from solid waste.

2.1.2 County and municipal solid waste management and resource recovery plans. All counties and municipalities, either solely or in cooperation with other counties and municipalities, are required to adopt and implement a local management plan by July 1, 1978, as required by the Florida Resource Recovery and Management Act, amended.

Department approval of local plans, subsequent to review by the Resource Recovery Council, will be based on conformance with Chapter 17-7, F.A.C., as required by Chapter 403, F.S. It is recognized that because of Florida's diverse population, size, economy, geography and even climate, different approaches to solid waste management and resource recovery planning will be necessary from one locale to another.

- 2.1.3 Resource Recovery Planning. The potential market for energy derived from solid waste is recognized as being the most stable and economically feasible. Primary efforts in resource recovery will be in this direction. Secondary efforts will be directed toward materials recovery to satisfy anticipated demands as the cost and scarcity of raw materials increase.

The 1980 goal for resource recovery from solid waste:

Area I (Rural), 46 to 49 counties

Solid waste generated: 1 million tons (projected)

Materials recovery: 1%

Area II (Urban), 18 to 21 counties

Solid waste generated: 9 million tons (projected)

Materials recovery: 8%

Energy recovery: 30%

- 2.1.3.1 Designated areas for resource recovery programs. Information in this section was extracted from the Resource Recovery Council's Interim Report to the Governor and the Legislature, dated March, 1976.

Under the provisions of Chapter 403.706, F.S., of the Resource Recovery and Management Act of 1974, Florida cities and counties face new solid waste planning requirements. As new opportunities to convert refuse into energy gain increasing attention, many local officials question the feasibility of recycling and energy recovery as an alternative to land disposal.

The Florida Resource Recovery Council is mandated by law to study the feasibility of resource recovery and to specifically recommend to the Department those counties, municipalities, or regions which should be required to plan for and engage in resource recovery. The purpose of this section is to summarize how the task of designating areas to plan for resource recovery was approached and to explain the basis for the recommendations.

Under the requirements of the Resource Recovery and Management Act, ". . .all counties and municipalities shall adopt, either solely or in cooperation with other counties and municipalities, a local resource recovery and management program which shall be approved. . ." by the Department of Environmental Regulation (DER) by July 1, 1978. But only those with sufficient solid waste to make recycling or resource recovery economically feasible, and which are therefore designated by the RRC, must actually plan for and engage in resource recovery.

Several criteria have been developed for assessing the question of economic feasibility. In addition to waste generation as specified in the Act, the RRC has included a major emphasis on energy markets and proper consideration of the status of technology.

The consideration of energy markets is absolutely essential. The composition of refuse is 70 to 80 percent combustible and can be converted into various fuels in a solid, liquid or gaseous form. Furthermore, increasing shortages of natural gas and the higher cost of oil and coal - - precious non-renewable energy resources - - make refuse derived fuels economically attractive. Finally, without markets for the energy value in solid waste, feasibility is difficult to establish, regardless of population and tonnage.

The economic feasibility of resource recovery is currently tied primarily to the energy value of solid waste. The energy value of solid waste is determined primarily by the cost of the fossil fuel it replaces, although other factors affect ultimate feasibility such as proximity to an existing energy user and a technology which can prepare a fuel product meeting the buyer's specifications.

To reduce the capital costs required, the emphasis has been on utilizing existing power plants - - both municipal and investor owned - - and selected industries.

The most important fact in evaluating the market potential of various energy users in the type of fuel used. More than anything else, the type of fuel dictates the cost of energy and hence the value of a refuse derived fuel to the potential user.

The fuel type also reflects the equipment used in the boiler design and establishes the limits for modifying the plant to burn a supplemental fuel. For example, most of the oil/gas boilers in Florida cannot use solid fuels without costly redesign.

Another important issue related to fuel type is the current natural gas shortage. Most boilers in the state use gas on an interruptible contract basis and thus require alternate standby fuels. All of the municipal utilities use oil as the standby.

The cost of oil is three times the cost of natural gas per million BTUs. As recently as 1973, most municipal utilities were burning gas to meet 90 percent of their energy requirements. In 1975, natural gas was estimated to supply 10 percent or less of their requirements.

Therefore, the value of a refuse derived fuel that can be used by these municipal gas customers has tripled in the short span of two years and the cost of fuel to these same energy markets has tripled, too.

In the majority of localities, due to the pre-dominance of oil and/or gas fired power plants, preliminary survey findings indicate that some type of pyrolysis technology is cost effective. In Hillsborough, Bay and Escambia Counties where there are existing powdered coal fired utilities, the supplemental firing of a shredded, prepared refuse derived solid fuel is justifiable. With the exception of the Tampa Bay area, and Escambia and Bay Counties, current utility fuel costs range from \$1.55 to \$2.06 per million BTUs. Clearly, fuel economics warrant further detailed investigation in each local area.

Ninety percent of Florida's population is distributed over 24 counties. Using 1980 population projections and assuming 100,000 population as the countywide threshold for judging feasibility, 19 counties emerge, containing 37 of the 43 municipalities with a current population over 25,000. Overlay the state wide evaluation of energy markets with the population base and a framework for judging feasibility comes into focus.

Three counties, Okaloosa, Lake and Marion, are within the population range but do not have viable energy markets. Energy markets have been identified in the following 19 counties.

The 19 county areas recommended are as follows:

Alachua	Hillsborough	Pinellas
Bay	Lee	Polk
Brevard	Leon	Sarasota
Broward	Manatee	Seminole
Dade	Orange	Volusia
Duval	Palm Beach	
Escambia	Pasco	

In Table 2-1 they are listed along with the type of energy markets available.

COUNTY	TYPE OF ENERGY MARKETS	UTILITY OWNER - TYPE
Alachua	Oil/Gas Municipal Utility	Gainesville/Alachua - Municipality
Bay	Solid Fuel Utility/Industry	Gulf Power Company - Investor Owned
Brevard	Oil/Gas Utility	Orlando Utilities - Municipality Florida Power and Light - Investor Owned
Broward	Oil/Gas Utility	Florida Power and Light - Investor Owned
Duval	Solid Fuel Industry, Oil/Gas Utility/Industry	Jacksonville Electric Authority - Municipality
Escambia	Solid Fuel Industry/Utility, Oil/Gas Industry	Gulf Power Company - Investor Owned
Lee	Oil/Gas Utility	Florida Power and Light - Investor Owned
Leon	Oil/Gas Municipal Utility	City of Tallahassee - Municipality
Orange	Oil/Gas Utility	Orlando Utilities - Municipality
Dade	Oil/Gas Utility	Florida Power and Light - Investor Owned
Palm Beach	Oil/Gas Utility	Lake Worth - Municipality Florida Power and Light - Investor Owned
Polk	Oil/Gas Municipality Utility/ Industry	City of Lakeland - Municipality
Seminole	Oil/Gas Utility	Florida Power/Florida Power and Light - Investor Owned
Volusia	Oil/Gas Utility	Florida Power/Florida Power and Light - Investor Owned

TABLE 2-1 DESIGNATED AREAS FOR RESOURCE RECOVERY

COUNTY	TYPE OF ENERGY MARKETS	UTILITY OWNER - TYPE
Hillsborough	Solid Fuel Utility	Tampa Electric Company - Investor Owned
Pinellas	Oil/Gas Utility	Florida Power - Investor Owned
Pasco	Oil/Gas Utility	Florida Power - Investor Owned
Manatee	Oil/Gas Utility/Industry	Florida Power and Light - Investor Owned
Sarasota	Oil/Gas Utility/Industry	Florida Power and Light - Investor Owned

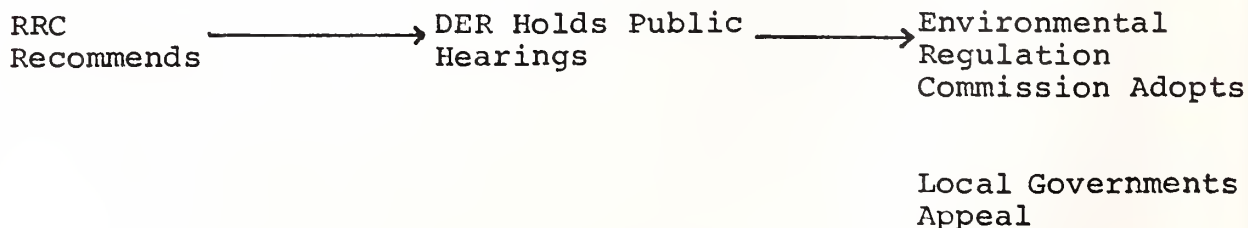
TABLE 2-1 (CONTD.) DESIGNATED AREAS FOR RESOURCE RECOVERY

As a result, local determination of the best planning arrangement will provide the needed flexibility for varying circumstances, and the countywide or regional designation assures better coordination of resource recovery planning. Each area designated to plan for resource recovery will receive information from the RRC based on their statewide study.

The information provided will not answer all questions, such as the impact of transportation costs, for example, or estimated cost and revenues from materials recycling, and many other site specific variables that determine capital and operating costs. But it will provide a preliminary basis on which local jurisdictions can decide how best to approach detailed feasibility studies or other planning activities.

The question of economic feasibility for resource recovery is complex and depends upon several interrelated factors that may vary from place to place. For this reason, local governments can appeal the designations made by the RRC, in accordance with Chapter 17-7, Part II, F.A.C.

The following diagram illustrates the process for the benefit of cities and counties:



2.1.4 Studies. Investigation of current solid waste management practices in the State will be conducted by the Department and Resource Recovery Council. The purpose of this action is to determine deficiencies and make positive proposals for corrective action.

Studies scheduled for completion in the short range time period are:

- (a) An evaluation of the potential for utilizing the current solid waste generated in the State as an energy source for existing facilities within the State.
- (b) A statewide survey of potential markets for materials recovered from solid waste.
- (c) Cooperative effort with the Tampa Bay Regional Planning Council to develop a comprehensive solid waste management and resource recovery plan for that area.
- (d) Solid waste studies to determine waste stream components and quantities for use in areas most suited to undertake resource recovery.
- (e) An inventory of hazardous waste sources, types, quantities, and current treatment or disposal methods.

2.1.4.1 New Resource recovery technologies and systems are continuing to be developed throughout the country. The results of these development efforts may be appropriate for demonstration or implementation in Florida. To properly assess the results of these efforts and to make them known to interested persons, the Department and the RRC will establish and compile information about existing technologies and systems from which the feasibility of each system or technology can be evaluated.

2.1.5 Hazardous Waste Control. Proper control and disposal of hazardous wastes requires adequate collection, treatment, and special disposal sites or facilities. The Department will conduct a survey for hazardous waste sources, types, quantities, methods of treatment and disposal, and collectors-haulers. Based upon this survey, appropriate

legislation and rules will be developed for control of dangerous wastes. A basic training and information course will be designed for solid waste specialists. All land disposal facilities, incinerators, solvent reclaimers and any other chemical, physical, or biological processes for waste treatment, will be identified and evaluated for the specific capability to handle various types of hazardous waste.

If it is determined that private sector facilities are inadequate or non-existent to handle the types and quantities of wastes encountered, action will be taken by this Department to locate and install facilities with adequate capability to collect, treat or dispose of hazardous waste. Such facilities may be State operated or licensed for operation by the State.

- 2.1.6 Financing Resource Recovery Facilities. Financial assistance is most likely necessary to carry out a successful resource recovery and management program. Financial burdens of planning, design, construction, and financing often exceed capabilities of local governments because resource recovery facilities have high capital costs.

The Department and Resource Recovery Council will endeavor to obtain or establish new grant and loan programs from the State Legislature or Federal Government to provide needed funds. Any financial support so obtained will be equally available to all qualified government entities.

Local governments will be encouraged to use the State Division of Bond Finance to arrange long term financing for resource recovery facilities.

- 2.1.7 State Procurement Policy. The Department of Environmental Regulation recommends that all State procurement agencies, especially the Department of General Services, purchase and use products containing recycled (secondary) materials. Such agencies should review their purchasing specifications with the objective of maximizing the recycled material content of items purchased. Consultation with appropriate supplying industries is urged. Revision of specifications should only be made after guarantees that public interest will be protected through quality control in manufacturing new items.

Local government agencies and private industry will be encouraged to adopt similar programs. This would serve to increase the market for waste-based products and may ultimately lower procurement cost of recycled products. When possible, preferential cost treatment should be given to recycled products.

2.2 Long Range Plans. Some elements of the long range plans are logical extensions of activities undertaken in the short range phase. The long range plan elements are those that can be reasonably projected to 1990 under present circumstances. Resource recovery from solid waste with protection of the environment is the major element of the plan and ultimate goal. In this sense, plans will never be complete, but incremental goals can be achieved and built upon as new methods and technology develop.

2.2.1 Land Disposal Solid Waste Facilities. Facilities using direct burial as a disposal method should be sanitary landfills. The number of these facilities should be reduced to one or two per county depending on quantities and types of waste generated. It is expected that each facility will be associated with a county or area wide collection system using 4 to 40 cubic yard containers for rural areas (container collection system). Municipalities would use a combination of systems using both individual residential collection in urban areas and container collection in outlying areas or small rural communities.

2.2.1.1 Collection costs, of necessity, have to be gauged to the type of service provided; i.e., individual billing for users of residential collection, while users of the rural container collection system could be billed through the local tax structure. The reason for the latter type billing, or need for a similar method, becomes apparent when it is realized that, if given a choice of paying individually to use a container or throwing their refuse along the roadside, many persons will dump promiscuously. If "free" use of the containers is encouraged (although paid for through taxes) promiscuous dumping should be reduced.

2.2.1.2 Reducing the total number of sanitary landfills as stated in 2.1.1 may appear to contradict the increased need for them if one accepts a continuing increase in State population accompanied by increased quantities of waste generated per person. However, by year 1990, it is optimistically expected that disposal sites of this type will only be necessary to dispose of residue from solid waste after processing for resource recovery or waste that cannot be economically processed. Optimally, burial will be the last method of disposal to be considered in the future.

- 2.2.2 County and Municipal Solid Waste Management Plans. Plans should be revised by public agencies, and re-evaluated by the Department of Environmental Regulation as necessary. The effectiveness of plan accomplishments should be evaluated, in addition to any revisions of projected goals.
- 2.2.3 Resource Recovery Planning. Areas which will have implemented resource recovery programs should be re-evaluated in cooperation with the RRC for possible upgrading of their programs. Expanded programs would be considered in those cases where a market demand exists that can be economically satisfied from wastes available at that time. Areas which have not had a recovery program may desire to undertake some endeavor. Recovery programs will continue to be dependent upon markets, available waste and improved technology.

The 1985 goal for resource recovery from solid waste:

Area I (Rural) 43 to 46 counties

Solid waste generated: 1.1 million tons

Materials recovery: 1%

Area II (Urban) 21 to 24 counties

Solid waste generated: 9.9 million tons

Materials recovery: 18%

Energy recovery: 50%

- 2.2.3.1 Resource recovery facilities are expected to become the hub for each area waste collection system(s). Facilities extracting energy from waste would logically proceed to recovering materials if not already doing so, or they could progressively recover a greater variety of materials as markets, technology and economic practicality become available.

In areas where energy recovery is not practical, resource recovery could be practiced for materials only, progressing to recovery of varieties of materials as circumstances permit. Such facilities are best located at central sanitary landfills, with consideration of transportation corridors.

The anticipated scarcity or cost of raw materials may make it most practical to develop small scale material recovery facilities at all central sanitary landfills. Recovered materials could be stockpiled on site until sufficient quantities are accumulated to make economical shipments to markets.

The Department of Environmental Regulation intends to work with the private sector to develop area collection networks and schedules to service these small facilities, and coordinate materials shipments to available markets.

2.2.3.2 The Department and Resource Recovery Council will monitor and evaluate new technology in collection, processing, disposal and resource recovery operations, and disseminate such information to local agencies.

2.2.4 Pilot Project for Resource Recovery. A pilot project, when approved and funded by the State Legislature, will be integrated into the State solid waste program to coordinate and advance existing technology in the field of resource recovery. The Department of Environmental Regulation, through contractual arrangements with private industry and public agencies, may then construct, operate, and manage the pilot project to demonstrate resource recovery and management to Florida public agencies and other interested persons. The project facility would be operated under contract for an initial period and subsequently converted to a regional waste processing facility as part of the local solid waste management plan.

2.2.4.1 Alternative Pilot Projects. Several alternative pilot projects will be considered for implementation at State institutions to stimulate recovery and reuse of the solid wastes generated by those State institutions. One such project is under way, conducted by the Department of General Services; i.e., collection and recycling of paper generated by State offices in the Capitol. Expansion of this program will be designed to include all State offices throughout the State.

Another such project might include the use of recycled or waste materials in State construction projects such as road construction.

2.2.5 Marketing Information Exchange. It is recognized that marketing materials recovered from solid waste would be facilitated by a Marketing Information Exchange. Such an agency would function as follows:

- (a) Continuously search for potential users of recovered resources; determine the economic value of the materials to supplier and user and match them together.

- (b) Collect and disseminate information regarding the quality, quantity and time of delivery of recoverable and marketable material.

The Department would encourage establishment of such a Marketing Information Exchange by the secondary materials industries and solid waste management entities, both public and private. The Department would seek funds to apply toward establishment of such an agency and would act as an initiator of this endeavor.

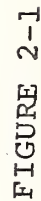
2.2.6 Waste Reduction. Waste reduction or source reduction involves policies that are intended to reduce consumption of materials and products to achieve reduction of solid waste generation. Four basic methods are involved:

- (a) Product reuse.
- (b) Use of less material in products.
- (c) Increased product life.
- (d) Decreased product consumption.

Implementation of any of these four methods involves alteration of existing production and marketing structures, many of them on a national scale. State and local governments are limited in their ability to implement waste reduction programs much beyond their own procurement policies. The Department will encourage manufacturing industries to eliminate product configurations that impede recyclability and product redesign to reduce the amount of materials contained in products.

The Department will support national legislation related to reduction of waste generation and recommend reasonable measures for the same to the State Legislature.

SUMMARY SCHEDULE



3.0 SUGGESTED OUTLINE FOR A LOCAL SOLID WASTE MANAGEMENT AND RESOURCE RECOVERY PLAN

A local or regional plan should be a written document outlining activities that the agency intends to undertake during the life-span of the plan. It should be a technical and policy statement containing objectives for solution of solid waste management problems, together with directions for achieving those objectives. It should be designed with a time sequence and order of priorities.

The following basic planning model can be used for the plan text to illustrate the logic followed in the local planning procedure. Planning initiative and innovation are desirable and each jurisdiction should formulate its own systematic plan to suit particular local needs.

3.1 ELEMENTS OF THE PLAN

3.1.1 Foreword or Preface Contents Section I, Introduction

The content of these elements will largely be suggested by the subject matter included in the plan text.

3.1.2 Section II, Summary

The findings and recommendations of the plan are summarized for quick reference and can be useful as a working document. The summary is usually placed at the beginning of the report and should note the appropriate page, paragraph, table or appendix used for any summarized information. A good summary can be excerpted from the plan, reproduced separately, and used for information purposes. A special summary condensation can be made into public relations material to gain citizen support.

3.1.3 Sections III and IV, background of the planning area, provide the framework for planning and an appraisal of existing conditions. The planning process is characterized by collection of data. Without data, it is useless to attempt to forecast, determine needs or set objectives. Data will be diverse, and only some will be useful for developing a plan for solid waste management. It is essential that information about all solid waste sources and supporting management systems be gathered to build the needed data base.

3.1.4 Section III, Background Data

3.1.4.1 Jurisdictions:

- a. Counties
- b. Municipalities
- c. Planning Area
- d. Special Districts
- e. Other

3.1.4.2 Physical Conditions:

- a. Environmental conditions
- b. Geology and soils
- c. Climatology
- d. Drainage basins
- e. Other pertinent physical features

3.1.5 Section IV, Existing Conditions.

This section should describe specific existing conditions affecting management of solid wastes in the following order:

- a. Storage practices, collection practices and routes.
- b. Quantities and types of wastes generated and collected; i.e., commercial, hazardous, industrial, municipal, sludges.
- c. Disposal and reduction facilities.
- d. General management practices; i.e., manpower and equipment utilization, waste collectors (public, private), terms of contracts.
- e. Population; size and density.
- f. Land use and zoning, residential, commercial, industrial, agricultural, extractive, recreational, solid waste facilities or other major land uses.
- g. Transportation routes; roads, highways, railroads, barge-ways; specifically used for solid waste management.
- h. Public awareness about solid waste problems and service requirements.
- i. Expenditures for solid waste management; collection, transportation, disposal, and costs for each in labor, fuel, maintenance, overhead, capital equipment.
- j. Public finance practices.
- k. Status of revenues to support the solid waste management system.

1. Other significant conditions related to existing solid waste management practices in the jurisdiction.

3.1.6 Section V, Future Conditions and Problem Requirements.

Information obtained from analysis of existing conditions data accumulated in Sections III and IV can be used to forecast future conditions, problems that may arise due to those conditions and what may be required to resolve those problems.

3.1.6.1 Anticipated conditions:

- a. Population projections
- b. Solid waste generation increase (or decrease) by type, source and quantity.
- c. Land use changes; zoning modifications

3.1.6.2 Future problems defined in terms of location, extent, persistence and control difficulties:

- a. Environmental
- b. Financial
- c. Technical
- d. Institutional
- e. Legal
- f. Political
- g. Other

3.1.7 Section VI, Objectives.

Objectives, based upon the need to solve previously defined problems, should be clearly stated. The following objectives may be used to solve solid waste management and resource recovery problems:

- a. Development of a solid waste management organization within each jurisdiction where one does not exist. The State Legislature has given counties and municipalities the authority, and requires them, to plan and provide efficient, environmentally acceptable resource recovery and management. To accomplish this, each jurisdiction should develop a solid waste management organization where one does not exist or update the current organization. This agency should have the responsibility for solid waste management and resource recovery within the jurisdiction, and power to make inter-governmental agreements to form regional solid waste management authorities, if appropriate.
- b. Acceptable collection and transportation methods.
- c. Provision for proper methods of waste disposal, disposal

facilities, vehicles, transfer stations, container collection system, operating equipment.

- d. Development of trained solid waste management personnel at both operating and management levels.
- e. Provision for sufficient financial and legal support for solid waste management.
- f. Public relations work to develop a better informed public regarding solid waste problems, service requirements and litter abatement.
- g. Land acquisition for future installations.
- h. Intergovernmental agreements to form solid waste management areas or regional authorities.
- i. Establish environmental requirements; soil survey, hydrogeological studies, other.
- j. Development of complementary county-municipal plans.
- k. Development of local ordinances or regulations to enforce the local program.
- l. Development of an area disaster plan.

3.1.7.1 Resource Recovery Area Objectives.

Those areas designated by the Resource Recovery Council as contained in Chapter 17-7, Florida Administrative Code, should consider the following objectives in their program in addition to objectives for a solid waste management program as given in the foregoing sections:

- a. Contracts with markets for the recovered energy or materials.
- b. Obtaining the optimum technology or resource recovery method to be used.
- c. Development of residual landfills for disposal of materials remaining after resource recovery.

3.1.8 Section VII, Recommendations for Action.

This section should specify what the jurisdiction intends to accomplish to solve solid waste management problems. The following items should be considered:

- a. Timing and priorities of intended action. Short and long term objectives should be defined.

- b. Location of intended action.
- c. Who should act (agency, department).
- d. Estimated costs.
- e. Problems that will be solved.
- f. Other.

3.1.8.1 Plan Action.

The following aspects should be considered for intended plan action. Each one should be supported by procedures for accomplishment and a schedule for action initiation:

- a. Ordinance development.
- b. Inspection and enforcement.
- c. Licensing and franchising of collectors and facility operators, if appropriate.
- d. Facility site location, acquisition, design, and zoning for a 20-year period for both sanitary land-fill and resource recovery.
- e. Transfer stations, container stations, transportation routes.
- f. Resource recovery systems and technology.
- g. Development of solid waste management operating departments and jurisdictions.
- h. Development of financing, budgeting and other operating management features.
- i. Hiring and training of solid waste management operating personnel.
- j. Operating contracts, resource recovery contracts, contracts for solid waste collection to include title to solid waste.
- k. Public information and education program.
- l. Candidate jurisdictions for inter-governmental agreements to participate in regional authorities.

3.1.9 Section VIII, Plan Implementation.

Any plan, unless implemented, has little value. In practice, planning never ends, while implementation often becomes necessary before the plan is actually completed. Implementation should be carried out according to a schedule and

order of priority. Critical implementation activities include organization, staffing, financing, acquisition and management of equipment, providing service, public relations, training, continuing planning, and general management.

3.1.10 Appendices.

This section of the document should contain supporting information and materials used to develop the plan. Content might include:

- a. Maps
- b. References
- c. Regulations
- d. Definition of terms
- e. Method of research and analyses
- f. Contracts
- g. Other

3.1.11 Plan Submittal Deadline.

Section 403.706, F.S., requires that all counties and municipalities shall adopt, either solely or in cooperation with other counties and municipalities, a local resource recovery and management program within two years after the Department of Environmental Regulation adopts the state program. The state program is effective July 1, 1976; therefore, local programs must be submitted by July 1, 1978 to the Department of Environmental Regulation for review by the Resource Recovery Council and approval by the department.

4.0 A METHOD FOR DEVELOPING A LOCAL OR REGIONAL SOLID WASTE MANAGEMENT AND RESOURCE RECOVERY PLAN

Planning is the conscious process for achieving objectives by rational consideration of possible contingencies and alternatives. A plan should guide intended action and specify the time and priorities to accomplish the intended action. The planning process is a systematic method of:

- a. Recognizing that a condition or problem exists.
- b. Collecting and analyzing data about the condition or problem.
- c. Defining the condition or problem in view of the analyzed data.
- d. Establishing objectives that will change the condition or correct the problem when attained.
- e. Determining methods, timing and priorities to achieve objectives.
- f. Evaluation of method effectiveness in achieving objectives and modification of the plan to meet changing conditions.

A plan should be modified during preparation to accommodate changing conditions; however, it should be formalized for continuing reference. Local and regional plans are intended to accomplish direct operation of a solid waste management and resource recovery system. State plans provide the broad framework of policies, regulations, standards and criteria by which local and regional planning can be accomplished.

4.1 Application. The local or regional plan for solid waste management should adequately:

- a. Provide an internal technical and policy guideline to accomplish the purposes of the local or regional solid waste management agency.
- b. Provide a public-directed framework of standards for local and regional solid waste management planning and implementation.
- c. Provide for an integrated management system of approved storage, collection, transportation, resource recovery and final disposition of solid waste through either direct operations, regulated performance, or a combination of both.

- d. Establish methods and procedures for translating the plan into system design and direct operations.

4.2 Coordination. Coordination is the essence of planning. Resolution of conflicting interests, allocation of available funds and other resources, intergovernmental and inter-departmental cooperation, and establishment of priorities requires coordination. A solid waste management plan is one among several functional plans, such as those dealing with streets, sewer and water, education, health, public safety, and recreation. Local and regional solid waste management plans, therefore, should relate to, and not conflict with other plans of the jurisdiction. It is also essential that State regulations, required performance standards and other provisions be considered in planning at the local and regional level. Particularly important in solid waste planning is coordination with the private sector which provides much of the solid waste services in many areas. The public must insure that it will receive a high level of total service at a reasonable cost from the private operator.

4.3 Basic Planning Model. A local or regional plan for solid waste management is illustrated in the 8-step model shown in Figure 1. The various steps should be considered as occurring simultaneously although in preparing the written plan report some jurisdictions may prefer to consider each phase in sequence. Each step can serve as a separate chapter or section of a plan report. A planning model should provide feedback into the system from various planning process events as these occur. The model itself has built-in controls to allow for correction of errors discovered through feedback relationships. Developments outside the planning process also cause corrections or revisions. Social, legal, and environmental changes can affect the plan and need to be considered.

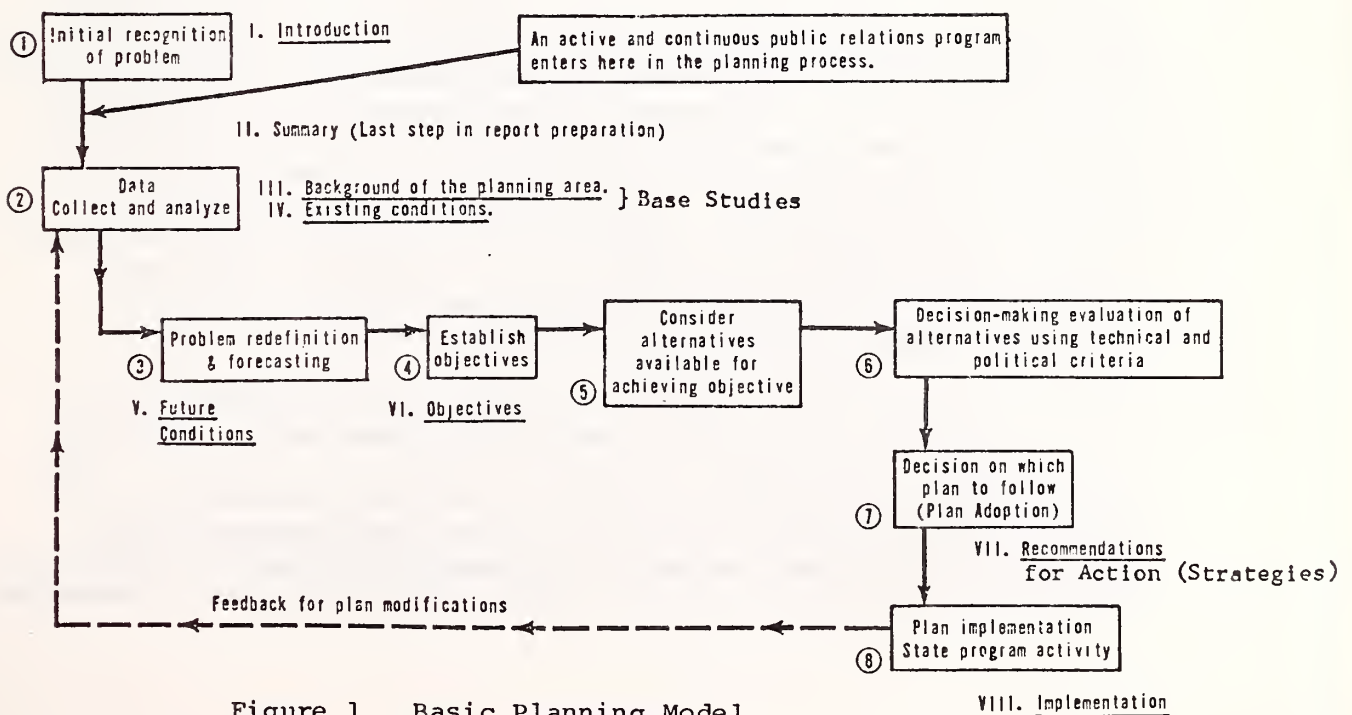


Figure 1. Basic Planning Model

VIII. Implementation

- 4.3.1 Initial Planning. Recognition of a condition or problem is the first step in the planning process and prompts the second action: data collection and analysis. Analysis of data will point up problem areas and situations requiring consideration in the plan (Figure 1, steps 1 and 2).
- 4.3.2 Problem Redefinition. The next step is redefinition of the problem and identification of such problems and conditions that will be relevant in the future. This requires forecasting (Figure 1, step 3).
- 4.3.3 Objectives and Consideration of Alternative Actions. Specific objectives may be set and alternate methods for achieving these must be considered (Figure 1, steps 3 and 4). Decisions in selecting alternatives are subject to many influences that must be considered when developing the local or regional solid waste management plan (Figure 1, steps 5 and 6). Such influences may be both constraints and resources and include political, legal, social, and financial factors, and available technology. Basic among these are political and technical influences. The technical nature of the decisions requires a specialized interdisciplinary staff to supply information and expert evaluation of alternative solutions and to implement the plan. Evaluation of existing State, regional, or local plans is an important part of this step. Solid waste management plans should be compatible with existing plans, assuming such plans take solid waste needs into account, i.e., the State Comprehensive Planning Act. Therefore, decision making for the solid waste management plan will be based to some extent upon political exigencies, specialized technical analysis, and existing plans.

Alternative solutions which appear feasible should be submitted to appropriate public officials and the public itself for review and possible adoption, but not without adequate preparation for such a step. This means a program of education for officials and the public - a vital and integral part of the entire planning process. The agency conducting the planning should have initiated an information and education program early in the plan formulation stages, and the public information plan should continue through implementation of the entire plan. News releases, films, articles, and speakers, for example, can help promote public awareness and aid in approval of solid waste management plans and programs.

- 4.3.4 Plan Establishment. Once the decision making stage has been completed, decisions should be translated into the recommended strategies and priorities that form the core of the plan (Figure 1, step 7). Planning is continuous and should proceed concurrently with implementation of previously planned proposals (Figure 1, step 8). Original plans will need reevaluation and modification to accommodate

changing situations. Earlier forecasts will require revision. This evaluation and modification will provide new information and along with the results of implementing the plan will be fed back into the planning process, as indicated in the model.

- 4.4 Base Studies. The purpose of base studies is to form a data base upon which to support succeeding analyses and recommendations. Base studies help to construct a logical framework within which rational planning can occur. Problems and limitations are identified, and available resources inventoried.

In planning for local and regional solid waste management systems, certain essential information must be assembled and analyzed. Minimum data requirements usually include population, economics, land use, governmental jurisdiction and structure, physical conditions, legal framework, public facilities and services which compete with or complement solid waste management, transportation, current solid waste practices, and solid waste collection and generation rates.

- 4.4.1 Land Use. Land use considerations are at the core of local and regional comprehensive plans. Local and regional land use planning focuses on better arrangements and uses of land in accordance with economy, public interest, convenience, health and safety, and amenity. Land use planning is especially critical to solid waste management problems. Land is needed for transfer, disposal, reduction, and resource recovery facilities. Usually land needed for these purposes must compete with other land needs. More importantly, public acceptance of solid waste purposes and needs must be gained. Usually reservation or acquisition of land for solid waste purposes is thwarted by public opposition.

Good land use planning for solid waste management requires consideration of air, water, and land pollution potential, transportation, economic location, population, relationship to overall community plans, and ultimate use of the land. In considering these elements for land use planning, solid waste must be viewed in three basic stages - generation point, transportation and final disposition. Derived or assumed solid waste generation rates, containing a growth factor and coupled with plans for land use, can yield a fairly realistic estimate of expected future solid waste generation, as well as the location or modes of generation. Zoning is also an indicator of the potential solid waste load on the system.

Transportation and final disposition of solid waste will depend upon generation locations, types of solid waste, and availability of sites for transfer stations, resource recovery facilities, and sanitary landfills.

These considerations must be included in planning the total system. Care should be taken to plan sites in accordance with the area's comprehensive plan. Indeed, sites for solid waste management must be an integral part of the comprehensive plan.

- 4.4.2 Population. Determination of past, current, and future population of a jurisdiction is an important planning consideration. When related to solid waste generation rates, land uses, employment centers, and other data, population information can help determine sources of solid wastes, equipment needs, capacities and locations of reduction and disposal facilities. Aspects of population which should be considered include: total size (past, current, future), family size, age distribution, densities (by either planning area, enumeration district, or census tract), and growth rates.
- 4.4.3 Economics. Knowledge about the economy of a jurisdiction will provide valuable insights about the existing and future generators of solid wastes, competition for public funds, and the ability of the jurisdiction to provide increasing revenues as demands for expenditures grow. Factors that should be examined include: industrial composition, employment groups, family income, retail trade, trade area, number of retail establishments, import-export (local and regional), tax base (assessed valuation), tax rates, and debt limitations and capacities.
- 4.4.4 Governmental Structure. In order to determine a jurisdictional organization structure for solid waste management in the plan, the existing governmental structure must be understood. If the planning area is to be developed for a regional authority, individual jurisdictions within the area considered will make problems more complex. The names, official boundaries, and powers and responsibilities of these jurisdictions will be particularly important. Close coordination must be maintained with all governmental units included in the planning area.
- 4.4.5 Laws and Ordinances. Plans for solid waste management will affect and be affected by state laws and local ordinances. Therefore, cognizance of existing laws and ordinances must be made. An inventory of all laws and ordinances pertinent to solid waste management should be assembled during the basic data collection stage of planning. Particularly relevant to solid waste management are laws and ordinances dealing with public health, zoning, subdivision regulation, building codes, public finance, intergovernmental agreements, air and water pollution, planning, and, of course, those dealing specifically with solid waste.

- 4.4.6 Public Facilities and Services. Public facilities and services in the planning area must be considered. Solid waste management will often compete for funds and other resources with these activities. Frequently, solid waste management is a function performed by these other activities; i.e., public works and street departments. In some cases these facilities and services can complement solid waste management. For example, existing utilities might be re-structured to include solid waste management. Central garages and yards might be used for transfer station sites or resource recovery stations.

During the basic studies survey information should be developed to show the relationship between solid waste management and the following public facilities and services:

Governmental centers	Health facilities
Public Works	Schools
Water and sewer	Central garages and yards
Service utilities	Shipping terminals

- 4.4.6 Physical Conditions. In determining location of solid waste reduction and disposal sites, consideration should be given to physical and natural conditions that provide adequate environmental protection. Some data which should be collected and analyzed include: topographic features; general soils; groundwater, flood areas; oil and gas resources; clay and rock deposits; timber; and local climatology.

- 4.4.7 Transportation. Solid waste cannot be moved for disposal or resource recovery without using one or more modes of transportation. The single most important and common mode is a street or highway. Other transportation modes are important to solid waste management and should not be ignored. These are; rail and barge routes that offer means of hauling solid waste for disposal or reclaimed materials for recycling.

Local or regional solid waste management plans should include an inventory of transportation facilities. This information should be evaluated in terms of present and future application to collection routing, hauls to transfer stations, disposal, and resource recovery facilities. Transportation facilities contained in local or regional comprehensive plans should be related to future solid waste management needs. Transportation data that should be collected are:

a) <u>Streets</u>	b) <u>Highways</u>
1. Primary	1. Interstate and Expressway
2. Collector	2. Primary
3. Local	

Specialized information might include:

- Travel-way width
- Number of traffic lanes
- Surface type
- Section length
- Present average daily traffic (ADT)
- Future ADT
- Peak hour % of ADT
- Operating speed
- Load limits (some vary with season)

c) Railroads

1. Long-line
2. Short-line
3. Yards

e) Terminals

1. Truck
2. Rail
3. Barge

d) Bargeways

1. Canals
2. Rivers
3. Locks
4. Intercoastal Waterway

4.4.8 Current Solid Waste Practices. Accurate and sufficient solid waste data is generally not available. Yet a solid waste plan cannot be developed without it. Specific solid waste data needed will require surveys, although good representative samples will often suffice.

Generally, current data needed in addition to that described earlier in Base Studies, will be concerned with the specifics of storage, collection, transportation, transfer, disposal, reduction, resource recovery, and various organizational management aspects. Examples of planning considerations and the kinds of data needed follow:

a) Existing Methods of:

1. Storage
2. Collection (type, frequency, quality)
3. Transportation (including transfer)
4. Disposal and/or reduction
5. Resource recovery and recycling

b) Waste Generation:

1. Location (Tons generated and collected)
Political Subdivisions
2. Major planning area
3. Sub-planning area

Amounts and Type (Tons generated, collected, and classified by components)

1. Residential
 2. Commercial
 3. Industrial
 4. Other
- c) Equipment and Property: (By type, capacity, life expectancy)
1. Collection equipment
 2. Transfer stations
 3. Land disposal
 4. Incinerators
 5. Resource recovery facilities
- d) Management Problems: (Refer also to Section 5.5 Management Considerations)
1. Overall evaluation
 2. Environmental effects (air, water, population densities, noise)
 3. Finance (capital, operating, fees, records)
 4. Organization
 5. Manpower
 6. Industrial relations
 7. Private/public systems (areas of responsibility)
 8. Contractual arrangements
 9. Regulation/enforcement
 10. Public relations

A complete analysis of the current and future effects of these data should be made.

- 4.5 Management Considerations. A sound organization is essential for an effective and efficient solid waste management system. The relationship of both the public and private sectors in solid waste management requires special consideration since each have important responsibilities. Manpower is a significant part of solid waste management systems and must be carefully considered. All positions should be considered, including equipment operators, clerks, administrators, and professional personnel in order to properly plan for short and long-term needs.

Equipment and facilities needs, purchases, operating and capital costs, maintenance and salvage procedures must be planned and developed within the system.

Development of public acceptance for the needs and

services of the system is critical to its success. An active public relations program should be a continuing part of the system's activities.

Operating and capital budgets must be prepared to plan expenditures for the system. Sources of revenue to support expenditures must be identified and evaluations made to relate actual cost of an integrated management system to adequate charges for services provided. A means of system control must be developed and maintained. Good accounting procedures with adequate records should be used to measure financial aspects, services performed, safety, employee performance, employee development and retention, and public attitudes toward the service. These important planning and operating considerations are examined and discussed in the following sections.

4.5.1 Organization. Implementation of technology and public service objectives requires an efficient and effective organization. Six points are crucial to the development of an organization for solid waste management; it must:

- a) be designed to achieve planned objectives;
- b) have authority and responsibility appropriate to the task;
- c) fit legally and logically into the overall jurisdiction of which it is a part;
- d) have adequate numbers of qualified personnel;
- e) have adequate capital and operating finances;
- f) be a total system that concerns itself with storage, collection, transportation, disposal, resource recovery and reuse of solid waste materials.

4.5.2 Appraisal. Existing organizational structures should be examined to determine their adequacy for solid waste management. Advantages and disadvantages, financing, establishment requirements, possible service effects and objectives of the solid waste management system should be compared in this appraisal. Results of this comparison may yield design requirements for the system's organization.

4.5.3 Design Considerations. Regional approaches are an important consideration as organizational possibilities. A region can be defined, by the local governments involved, as an area that may comprise a whole county or several municipalities in a county or portions of one or more counties or one or more whole counties. Operating forms, such as utilities, authorities, joint agreements, contractual arrangements, and agreements should be considered within the regional context. The concept of maximum operational authority should be observed. This means a solid waste management system should be installed throughout an entire region and operated universally on an integrated management

basis. Everyone would receive solid waste service. In a rural region, maximum operational authority would mean that no person, business, city, or any entity would lack an approved collection and disposal service. Charges for service would apply universally and reflect the total cost of the service. Varying charges would be allowed for different levels of service. In an urban region, the maximum operational authority should encompass the entire metropolitan area.

- 4.5.4 Intergovernmental Mechanisms. To solve problems within a regional configuration, appropriate legal organizational mechanisms must be established. They should be oriented toward intergovernmental cooperation to unify the numerous and often conflicting individual jurisdictions in a regional area.

The regional configuration should establish a solid waste management system having maximum operational authority, delineated in a way that serves the largest population.

Incompatibility will often require establishing separate, adjoining operating regions. Delineation of a city, county, or group of cities or counties will often provide a convenient organizational framework for a solid waste management system.

Three main intergovernmental mechanisms are possible:

- a) joint operation of a facility by two or more units;
- b) provision of a service on a contractual basis by one governmental unit to at least one other;
- c) regional authority supervised by a board of commissioners or directors with day-to-day operation delegated to a manager and staff.

All three can be modified depending upon circumstances.

- 4.5.4.1 Joint Operations. Local units of government may agree to jointly perform service. Agreements can be used to undertake together any functions and responsibilities that each unit could undertake singly.

Financing techniques used by a local government acting alone can usually be applied to joint operations. User charges might be levied for direct operations and to retire revenue bonds. In other situations, funds might be provided from general revenues derived from tax

levies imposed by each participating governmental unit or from special taxing powers of the solid waste management jurisdiction. Exact methods would depend upon State statutes and preferences of the participants in the joint agreement.

4.5.4.2 Contractual Services. Services provided under contract include those supplied by one governmental unit to other units, by private operators, or by some combination thereof. Florida has enacted legislation that enables its local units of government to enter into such agreements. (Reference; Chapter 163, Florida Statutes) Advantages are elimination of duplicate services, staffs, and expenditures among several neighboring units of government. Operations and budgets are also more easily planned. If private contractors are used for services, the governmental unit does not have to hire and maintain its own employees, and costs will be fixed for a definite period and thus provide a more positive planning base. The contract must insure quality uninterrupted service by the contractor. Contracts should be awarded for longer terms than has usually been the practice to allow for capital commitment for equipment, sites, and other acquisitions as well as providing a stable work force.

4.5.4.3 Regional Authority. In approaching solid waste management on a regional basis, intergovernmental agreements must be further formalized by establishing organizational entities that permit operations, possible taxing or user fee assessment powers, and incurring debt.

A regional board, with the authority, could take advantage of several approaches such as organizations that operate as a utility having maximum operational control, for an integrated solid waste management system. The board-utility would have the power to license and regulate private contractors, regulate local government operations, or to undertake its own collection, transportation, disposal, reduction, and resource recovery operations and to establish and enforce standards for a specific region. Financing its own facilities or leasing them to private contractors could be equitably done with funds derived from user charges and revenue bonds. Operational management would be the responsibility of a manager answering to a board of directors or commission.

Another approach would be a division of authority and responsibility along functional lines for different governmental levels. In this case a regional agency would provide capital investment and operation of transfer stations, sanitary landfills, resource recovery stations, and other large facilities. Local jurisdictions

would conduct collection services and other strictly local functions. Such activities require intergovernmental agreements governing operations, financial arrangements, and designation of responsibilities.

- 4.5.5 Financial Planning. An essential aspect of developing plans for solid waste management is to provide means of financing the plan implementation. Financing identifies and describes methods for providing funds for acquisition of facilities and equipment and their operation. Funds may be derived from a mixture of several sources including long and short term debt, revenues generated from operations, tax levies, and sale of surplus assets. Sources must be identified during planning. Questions to ask in developing plans are: can capital funds be obtained through general obligation or revenue bonds; what are the debt capacities; will general tax levies be applied over the service area, or can revenue be generated by direct service charges.

This information can provide the basis for a budget showing how resources will be acquired and used over a specified time. A solid waste management plan should include a capital budget describing investments in capital equipment and facilities, estimates of cost, and schedule of acquisition. An operating budget should also be included showing estimated operating costs for the first few years of the plan life.

- 4.5.6 Manpower Planning. Manpower needs and personnel management are one of the major concerns in a solid waste management system. To reduce uncertainties about manpower plan for the future and provide system continuity, a manpower plan should be a part of the local or regional solid waste management plan. Such a plan should list all position classifications in the system, existing personnel in each classification, an estimate of personnel required for these positions during the next five or ten years, and estimated personnel costs for these periods. Retirements and attrition should be anticipated by determining ages of employees and application of normal turnover rates. Estimates of transfers should be included in these computations. Planning for manpower should also include training needs and programs to prepare employees initially and to maintain their knowledge and skills during employment. Changing requirements for certain skills must be anticipated in the plan and become part of the retraining program. For example, supervisors might need training in the distribution and economics of secondary materials as emphasis shifts from disposal to recycling.

- 4.5.7 Industrial Relations. An immediate challenge to many solid waste management systems is the insistence of employees to assert their rights through work stoppages

and permit continued service to the public.

Successful methods have been available for many years in the private sector:

- a) Acceptance and legal designation of a bargaining agent;
- b) Negotiation of a collective agreement or contract;
- c) Grievance and arbitration procedures. Grievance procedures should be designed for early resolution of issues to avoid entering into arbitration. Indeed, it is a public responsibility to assure a fair hearing of all grievances and demands in exchange for the public employee's agreement not to strike.

Strikes are always a possibility even if grievances are fairly heard by the public employer. Arbitration should be used in public labor relations whenever possible in order to avoid work stoppages. If voluntary arbitration cannot be established then compulsory procedure should be used particularly in emergency situations where work stoppages threaten to impair public health or welfare. Illegal strikes have been occurring with increasing frequency in recent years. A strike plan should be prepared to carry on essential services if negotiations break down. Legal steps must be considered as well as maintenance of security for public property. Procedures should also be outlined for action to take once the strike is over.

Public employees are usually represented by experienced negotiators having power to make contract commitments. Often the public's bargainers lack power to commit the public to contractual decisions. Therefore, the solid waste management plan should contain procedures for making contract commitments by a responsible group composed of both public legislators and executives. The public's collective bargaining group should be aware of and give special attention to presenting the jurisdiction's objectives in the contract, determining key policies on management rights (public interest), work rules, job security, and relationships to civil service or merit system provisions.

4.5.8 Public Relations. An active campaign should be conducted to improve the image of solid waste management by demonstrating to the public what is considered the highest quality of solid waste management and what the public can do to achieve this quality. Available techniques and methods include:

- a) Talks to service clubs, schools, women's clubs, community action groups, government officials and others;

- b) Provide information for dissemination by newspapers, radio, and TV;
- c) Disseminate information on solid waste practices and environmental conditions.

4.5.9 Advisory Committees. Guidance and support for a solid waste management planning and implementation can be obtained from an advisory committee at local or regional levels. Specific purposes of the committee must be determined and criteria established for selecting members. An advisory committee with broad responsibilities might serve to:

- a) Provide technical insight;
- b) Coordinate with other public agencies, such as those concerned with air, water, local government, and State and regional planning;
- c) Provide an interface between solid waste planning and operations if these activities are part of different agencies;
- d) Offer policy direction.

Advisory committees should be limited to presentation of recommendations and resolutions of approval. Disagreements should be resolved or modified during sessions of the committee. Final decisions must reside with the responsible solid waste management agency.

4.5.10 Property and Equipment Management. The plan should incorporate specific provisions for acquisition of equipment and other capital property on a scheduled basis, considering capital and operating costs and source of revenues. Schedules for maintenance, retirement, and final disposition of all property should be included in the plan.

Physical protection of these properties against carelessness and theft must be covered. Inventories of spare parts and salable reclaimed materials can be controlled through adequate record-keeping of incoming and outgoing items. Properties should be insured and employees directly handling these properties should be bonded. While this form of protection provides for recovery after a loss, it does not prevent loss. An unrecognized loss of property is that resulting from little or no maintenance. Poor maintenance results in higher operating costs, interrupted services, and earlier than planned replacement. Therefore, a preventative maintenance program is essential to insure that all property will remain serviceable for its planned life.

4.5.11 System Management Evaluation. Evaluating results of a system is an important function of management.

Often, solid waste management performance is not critically evaluated and consequently, service deteriorates, inefficiency abounds, and costs increase faster than necessary.

Although solid waste management systems differ, there are common factors which can be evaluated. Critical factors must be identified; i.e., manpower costs, equipment, supplies and facilities. Costs must be listed in manageable units, not in large aggregates which make it difficult to pinpoint problem areas.

A useful performance evaluation tool is the operating ratio. Such ratios are mathematical proportions between major expenditures and performance elements in the system. Example: One collector is normally able to collect four tons of solid waste in a task day based on an overall workforce average. The ratio value is 0.25 as shown in the equation:

$$\frac{1 \text{ Man-day}}{4 \text{ Tons}} = 0.25$$

A norm might be established at the 0.25 figure for the entire collection workforce and related to the total tonnage collected. Variance from this norm indicates to the manager that a change in operation occurred. An unfavorable change in operation could result in higher costs per ton collected. If this variance persists the cause must be determined and corrective action taken. System norms must be based upon method of operation and levels of service. In all cases, accurate measurements and record-keeping are necessary to make reliable and valid evaluations.

Other ratios can be developed to evaluate frequency of accidents or performance of equipment during a working period. Business ratios are useful in solid waste management too. The "current ratio" which is a relationship of current assets-to-current liabilities is an example. This ratio is commonly used in private business to determine the adequacy of working capital and the company's ability to meet its day-to-day obligations.

The use of operating ratios in solid waste management, if carefully selected and applied, can provide measurements which could make better management easier. The result could be a higher level of service to the consumer at a more equitable cost.

- 4.6 Management Techniques. A number of management techniques are applicable to the field of solid waste planning and management. These include statistical methods which are appropriate to analysis and forecasting of solid waste generation rates,

population, economic conditions, and future land uses. Other techniques aid in scheduling, budgeting, and evaluation. Use of project teams with interdisciplinary representation is desirable in solid waste management planning. A typical interdisciplinary solid waste planning team may include: an urban or regional planner, management specialist, engineer, economist, operations research specialist, lawyer, and ecologist. The project manager might come from these or other disciplines, but he should be capable of producing results through synthesis of the team's special skills and knowledge.

- 4.7 Plan Implementation. The plan should be scheduled to be implemented by jurisdiction officials as soon as possible after the plan has been reviewed by the Resource Recovery Council and approved by the Department of Environmental Regulation.

Activities essential to the implementation of a local or regional solid waste management plan include organization, staffing, financing, acquisition, construction, and management of facilities; acquisition and management of equipment; providing service, public relations, training, continuing planning, and general management and control. Implementation should be carried out according to a schedule and order of priority. Responsibility of action, estimated costs, and objectives of the implementation should be specified.

- 4.7.1 Organization. Requisite for implementation of a solid waste plan is an organization. An overall jurisdiction with operating divisions and sections must be formed. This organization can take several forms, but an area-wide agency having maximum operating authority is advantageous.

The divisions and sections of the agency should be designed to provide organizational support functions and to carry out an integrated approach to management of storage, collection, transportation, reduction and disposal, and reclamation. Establishing an organization should include policy and procedures development and execution, contract management and legal affairs activities, forms, records, reporting system, and establishment of a board of directors and a possible advisory committee. Operating management personnel should be appointed, consisting of a chief executive or administrator followed by division and section managers. Overall organizational staffing should proceed as the next logical step.

- 4.7.2 Staffing. Personnel recruitment and selection is a necessary part of implementing solid waste management plans. Hiring qualified personnel should be guided by present and future needs that have been projected in the manpower planning section of the plan. Modern methods of personnel management and industrial relations should be used for all employees.
- 4.7.3 Financing. Methods of capital and operating financing must

be established. Funds may be derived from debt instruments, tax levy, or from operations revenue. A combination of these funding methods might be used. Proposals for methods of obtaining financial assistance from other agencies may be solicited. Budgeting procedures for capital and operating needs must be part of the system for long and short-term financial planning and management. Most importantly, financing and budgeting records must be installed and maintained.

4.7.4 Acquisition of Facilities. Implementing a solid waste plan requires acquisition and development of facilities. These might include land, buildings, trucks, earthmoving and other equipment. Site location, architectural and engineering design, and construction are required. Equipment performance must be determined and specified prior to acquisition. Management of all facilities and equipment must be provided by qualified personnel.

4.7.5 Providing Service. The primary function of the solid waste organization is to provide the solid waste services of collection and disposal. Objectives and responsibilities of each operational agency will vary, but additional services might include many of the following:

Non-residential waste problems must be studied in order to provide expanded service by collecting and disposing of them. Such wastes may include those generated by hospitals, schools, correctional institutions, and industrial or commercial concerns. Regional solid waste management organizations will find it necessary to provide technical assistance in solid waste management to participating local government, industry, or commercial establishments. Other services may include inspection of equipment, facilities, and storage practices for compliance with State regulations or as part of the local regulatory responsibility. Reclamation of materials or energy from solid waste may be conducted or sponsored by the solid waste management agency. Sale of reclaimed materials could help offset operating costs or retire debt. In either case the consumer of solid waste services would benefit through lower cost of the service.

4.7.6 Public Relations. An active and imaginative public relations program should be conducted. This will help build the image of solid waste management, demonstrate standards of high performance of solid waste management so that the public becomes accustomed to high performance and continues to demand it, and generally informing the public about how solid waste management relates to other aspects of their daily lives.

4.7.7 Training. The solid waste operating agency should determine the status of technical skills available in the conduct of

solid waste management and assess the need for increased technical training to meet future needs. Pre-service and in-service training in solid waste management are methods for developing needed knowledge and skills. A training program might include:

- a. Encouraging management and technical training in colleges and universities.
- b) Arranging for field courses and demonstrations for public officials, operating personnel, and other interested parties.
- c) Special training for operating personnel to prepare them for certification examinations.

4.7.8 Continued Planning. A significant part of the local or regional solid waste management plan must be aimed toward development of a continuing planning program to further effective solid waste management. Continuous planning program activities are:

- a) Review and updating of the local and regional plan at periodic intervals. This review might require the development of an inventory system to regularly update the data and evaluate the status of current solid waste management practices. A management information system (MIS) is extremely useful for this purpose.
- b) Periodic assessment of the implementation progress of local or regional operations.
- c) Continuing technical, financial, and legal consultation, guidance, and assistance to participant solid waste management units in the region. This service could also extend to industry, agriculture, and commerce.
- d) Periodic evaluation of the solid waste plan in reference to the overall comprehensive plan of the jurisdiction.

4.7.9 General Management and Control. The solid waste management agency is required to conduct various administrative functions. These functions include accounting services and billing, fiscal controls, performance evaluations, certification of operators, licensing and franchising, contract management, insurance administration, payroll administration, personnel management, industrial relations, and record-keeping. Procedures for these administrative functions should be established.

In addition, general management activities require ordinances dealing with solid waste management. The administration of a management information system should be part of general management.

Coordination is important among general management activities. Solid waste planning must be coordinated with activities of other agencies. In most jurisdictions other agencies have interests that overlap those related to development and implementation of a solid waste management plan.

The solid waste agency should not only consider the agencies with which planning must be coordinated but also indicate specific ways in which coordination will be assured. Coordination of local or regional solid waste disposal planning should be integrated with activities of other agencies within the jurisdiction as well as with the Department of Environmental Regulation. Coordination will aid in development of local or regional plans as well as provide mutual access to planning data and promotion of comprehensive plans.

Although emphasis is on development of regional plans, local plans should not be neglected. Rather, they should be developed and coordinated for inclusion in the larger regional plan. Certain elements such as operating standards and regulations should be uniform with the region. In order to ensure the effective coordination of all planning efforts throughout a jurisdiction, the solid waste planning agency should develop and implement its plan with the full support, knowledge, and assistance of appropriate local, regional and state jurisdictions. Indeed, many of the activities carried out by a solid waste planning agency will require the support and assistance of these agencies.

5.0 SOLID WASTE MANAGEMENT TECHNIQUES

- 5.1 STORAGE. Proper solid waste management is an effort to protect the public health and safety and prevent environmental degradation and it must take into consideration the storage of solid wastes. Fly generation and propagation of other vectors is closely linked to the adequacy of solid waste storage. If containers have tight fitting closures and they are kept reasonably clean, then the problem of flies and vermin will be minimized.

Many counties and municipalities have not defined proper storage for solid waste, thus the storage and collection systems are often haphazard at best leading to public health problems and inefficient collection operations.

The following recommendations are considered some of the safest and most convenient storage methods.

- 5.1.1 Reusable waste containers should be designed to facilitate the discharge of the compacted solid waste by gravity. Containers should be equipped with handles or bails to facilitate handling. Containers should have covers which are tight fitting and equipped with a suitable handle.
- 5.1.2 Single use paper and plastic bags should be used only when specifically engineered for the purpose of storing solid waste.
- 5.1.3 Putrescible waste should be drained of all excess moisture and wrapped before being placed into any storage container.
- 5.1.4 Yard trash such as leaves, shrubbery, lawn clippings, and material subject to scattering should be containerized for most efficient collection. Large items such as tree limbs, palm fronds, etc. may be put in containers or bundled in a size and weight consistent with the handling capability of the collection service.
- 5.1.5 Hazardous wastes such as acids; caustics; explosive materials; rags or other materials soaked in volatile or inflammable materials; drugs, poisons; radio-active materials; highly combustible materials; soiled medical dressings, clothing, bedding and/or waste contaminated by infection or contagious disease; and other materials which may present a special hazard to collection of disposal personnel or equipment or to the public should be given special consideration when setting out for routine collection.
- 5.1.6 Empty containers of pesticides registered for use in the home and garden, and materials originating in the home contaminated by infection or contagious disease should be securely wrapped in several layers of paper and disposed of during routine solid waste collection. All other hazardous wastes originating in the home should either be rendered safe and sanitary or

safely stored and clearly identified as a hazardous waste.

- 5.1.7 All containers for storing hazardous wastes should be of "international orange" in color and labeled with "Hazardous Waste" in black letters at least three (3) inches high.
- 5.1.8 Each mechanically serviced, bulk-type container should bear the name and telephone number in letters and numerals at least one inch high, of the contractor, franchiser or agency which services the container. When serviced, all storage containers should be completely emptied of all solid waste. In the design of new buildings or other facilities, there should be provisions (made as a prerequisite to issuance of building or other applicable permits) for storage which will accommodate the volume of solid waste anticipated, be easily cleaned and maintained, and allow for efficient and safe collection. Any unsatisfactory container used for the storage of solid waste should be removed from service. When bulk container service is available, the local regulations should limit the number of small containers set out for collection at a single location.

- 5.2 COLLECTION. The purpose of this section is to provide the essential information for understanding the requirements of solid waste collection systems.

Collection is the most expensive element in solid waste management, but this fact is often overlooked. There is an attitude that garbage collection is just a necessary evil and it must be carried out, at the expense of the users, through billing for the service or taking the operating cost from the general fund.

Many systems now in operation were not properly designed in the beginning. Many are in need of updating. The collection system should be designed to meet the specific needs and desires of the service area, in the most efficient manner possible. The service should be provided on the basis of user satisfaction at the lowest practical costs.

- 5.2.1 Collection system elements. The complexity of collection systems is evident, with no two systems being the same. However, there are basic collection system elements which are to be considered whenever a municipality is designing or redesigning its system.

The organizational form of the system must be determined. Basically this is a determination of whether the collection system will be operated by the public sector or the private sector.

The organization of a collection system can be a very complex undertaking. Questions such as administration, management, operations, financing of the system, and technical capabilities required to develop and/or improve the system must be answered before any collection can be expected to run at peak efficiency.

The basic elements of any collection system include:

- a. Customers to be served.
- b. Materials to be collected.
- c. Frequency of collection service.
- d. Points of collection.

Once decisions on these four items have been determined, the next important elements can be considered. These are:

- a. Collection vehicle requirements.
- b. Labor requirements.
- c. Collection route systems.

At this point, the location of the disposal site or the resource recovery facility must be known, as this will affect the final determination of the size and type of equipment and collection route layouts. It may be necessary to develop a transfer station to obtain acceptable level of efficiency for the over-all system.

If the solid waste service system is to include some form of solid waste processing for recycling and resource recovery (as should be the ultimate goal of any Florida system) then this factor would also affect the selection of equipment, labor, and collection routes.

- 5.2.2 Customers served. In the development or improvement of a solid waste collection system, one of the basic decisions to be made is who will be served by the system.

Cities that provide public agency collection services usually collect residential solid waste. Some cities collect solid waste from downtown businesses as well. In order to clarify collection service customers other than residential, other customers and services will be described according to the Standard Industrial Classification System designations.

- 5.2.2.1 Residential Customers. The majority of solid waste normally associated with municipal type collection operation is residential collection. In metropolitan areas, an average of 3.5 pounds per day of solid waste per person may be collected from residential units. This amount does vary greatly, however, due to living standards, season of the

year, size of residential property and other factors.

The usual system of collection in urban areas is house-to-house collection. The density of the housing effects the cost of the system. As the density decreases, the cost increases and at some point (usually considered two houses per acre) it is no longer practical to provide house-to-house collection services.

Most all multi-family housing units are handled by a bulk container collection system.

Rural residents that are not served by an urban collection system will be discussed in a following section, "Guidelines for Rural Collection Systems."

- 5.2.2.2 Industrial Customers. Industrial customers for solid waste collection services include all establishments engaged in some form of economic activity. Municipal solid waste collection systems do not ordinarily collect solid waste from heavy industry, but they do provide pickup for the many businesses serving the community, i.e., retail stores, restaurants, drug stores, motels, hospitals, schools, etc.

Table 5-1 shows some of the numerous businesses and industries as classified by the Standard Industrial Classifications (S.I.C.) divisions. In order to design the most efficient

TABLE 5-1
MAJOR GROUPS CODE NUMBERS
INCLUDED IN THE MAJOR STANDARD
INDUSTRIAL CLASSIFICATION (S.I.C.)
DIVISIONS

<u>Major Group Numbers</u>	<u>S.I.C. Divisions</u>
01-09	Agriculture, forestry, and fisheries
10-14	Mining
15-17	Contract Construction
19-39	Manufacturing
40-49	Transportation, communication, electric, gas, and sanitary services
50-59	Wholesale and retail trade
60-67	Finance, insurance, and real estate
70-89	Services
91-94	Government
-99	Nonclassifiable establishments

Source: U.S. Office of Statistical Standards, Standard Industrial Classification Manual, Executive Office of the President/Bureau of the Budget, 1967.

system, these businesses must be surveyed and amounts of solid waste produced known.

- 5.2.3 Materials to be collected. Once the type customer for a collection service is established, the "materials to be collected" and approximate amounts must be determined. Table 5-2 lists solid waste sources and types.

TABLE 5-2
SOLID WASTE SOURCES AND TYPES

<u>Class</u>	<u>Source</u>	<u>Type</u>
Residential	House & Apartments Trailer Villages	Household garbage, paper, rubbish, palm fronds, grass clippings, tree trimmings, furniture, bedding and appliances
Commercial	Restaurants, hotels & motels, stores, markets, offices, airports, shopping centers & service stations	Food service wastes, vegetable & meat trimmings, paper, cardboard cartons, cans, bottles, waste oils & greases
Institutional	Hospitals, schools, churches, public buildings, federal facilities, incinerators	Same as commercial plus toxic hospital waste, single use hypo needles & related hospital items, fly ash & incinerator residue
Industrial	Meat packing & food processing, furniture factories & sawmills, metal producers & fabricators, chemical & petroleum products manufacturers, papermills, power plants (steam & nuclear)	Meat, vegetable & fruit culls, skins, & trimmings, lumber & metal scrap, sawdust, ashes, slag, chemicals, spend oils, & hazardous materials (toxic, poisonous & nuclear)
Agricultural	Groves, vegetable, fruit & dairy farms, sugarcane fields, cattle feed lots	Trimnings, rejects, culls, vines, stalks, animal manure, & sheet plastic (used in growing strawberries)
Construction & Demolition	Building, remodeling or demolition of houses, apartments, stores & factories	Wood, tile, metal & asphalt scraps; glass, broken concrete, rocks, bricks, plaster, sand & gravel
Land Clearance	Clearing land for new construction, highways, streets, railroads, airports	Tree stumps, logs, brush, fence wire, broken concrete & asphalt
Special	City streets & roads, sewage treatment plants, animals killed, abandoned cars & appliances, parks & recreation areas	Street sweepings, sewage sludge, dead animals, abandoned cars & appliances, picnic debris, litter & containers

These wastes have been "typed," one through six for purposes of incineration and for clarity when dealing with solid waste. This system has proven useful in defining waste types in local ordinances. (See Table 5-3).

TABLE 5-3

TYPES OF WASTE

TYPE 0 - Trash, a mixture of highly combustible waste such as paper, cardboard cartons, wood boxes, and combustible floor sweepings, from commercial and industrial activities. The mixtures contain up to 10% by weight of plastic bags, coated paper, laminated paper, treated corrugated cardboard, oily rags and plastic or rubber scraps.

This type of waste contains 10% moisture, 5% incombustible solids and has a heating value of 8500 B.T.U. per pound as fired.

TYPE 1 - Rubbish, a mixture of combustible waste such as paper, cardboard cartons, wood scrap, foliage and combustible floor sweepings, from domestic, commercial and industrial activities. The mixture contains up to 20% by weight of restaurant or cafeteria waste, but contains little or no treated papers, plastic or rubber wastes.

This type of waste contains 25% moisture, 10% incombustible solids and has a heating value of 6500 B.T.U. per pound as fired.

TYPE 2 - Refuse, consisting of an approximately even mixture of rubbish and garbage by weight.

This type of waste is common to apartment and residential occupancy, consisting of up to 5% moisture, 7% incombustible solids, and has a heating value of 4300 B.T.U. per pound as fired.

TYPE 3 - Garbage, consisting of animal and vegetable wastes from restaurants, cafeterias, hotels, hospitals, markets, and like installations.

This type of waste contains up to 70% moisture, up to 5% incombustible solids, and has a heating value of 2500 B.T.U. per pound as fired.

TYPE 4 - Human and animal remains, consisting of carcasses, organs and solid organic wastes from hospitals, laboratories, abattoirs, animal pounds, and similar sources, consisting of up to 85% moisture, 5% incombustible solids, and having a heating value of 1000 B.T.U. per pound as fired.

TYPE 5 - By-product waste, gaseous, liquid or semi-liquid, such as tar, paints, sludge, fumes, etc., from industrial operations. B.T.U. values must be determined by the individual materials to be consumed.

TYPE 6 - Solid by-product waste, such as rubber, plastics, wood waste, etc., from industrial operations. B.T.U. values must be determined by the individual materials to be consumed.

- 5.2.4 Frequency of Collection. Due to health and sanitation considerations, the minimum acceptable frequency of collection for residential wastes containing garbage or food wastes is twice a week.

Studies in California have shown that twice-a-week collection is more effective in fly control than once-a-week collection. However, control of the fly problem is more closely linked to proper selection and maintenance of storage containers than to frequency of collection.

From a health and sanitation viewpoint, even two collections per week will not help reduce fly populations substantially when the garbage containers are not maintained in a sanitary condition.

Schools, hospitals, restaurants, etc. may require daily collection depending on the storage capacity.

In some areas where collection is more than twice per week, a reduction in collection frequency by one pickup per week can greatly reduce the operational costs in the collection system.

- 5.2.5 Points of Collection. To the citizen, the collection point is probably the most important aspect of the collection system. The main issue is who carried the refuse from the house to the curb. Two basic options are available:

- 5.2.5.1 Curbside/alley collection requires the citizen to place the solid waste at the curb or alley for collection and to retrieve any empty storage containers.

- 5.2.5.2 Backyard collection which usually takes one of four forms:

- a. Tote barrel - the collectors walk to the storage containers, empty them into an intermediate container and leave the containers in place.
- b. Set out - the collectors carry the refuse containers to the curb for collection and the citizen retrieves the containers.
- c. Set out/set back - the collectors carry the refuse containers to the curb for collection and return them to their storage place.
- d. Satellite Vehicle System - small capacity vehicles are used to traverse long distances between the refuse containers and the larger vehicle.

Recent trends, as evidenced in St. Petersburg, Florida; Fort Worth, Texas; Akron, Ohio; Atlanta, Georgia, are away from backyard and toward curbside collection. Some communities provide both curbside and backyard service - each at different fees.

Along these same lines, estimates of the quantities of wastes produced can be seen in Table 5-4. It is significant to note that these figures do vary and there is no substitute for actual surveys to determine types and quantities of solid waste to be collected.

TABLE 5-4

ESTIMATE AMOUNTS OF SOLID WASTE

<u>CLASSIFICATION</u>	<u>BUILDING TYPES</u>	<u>QUANTITIES OF WASTE PRODUCED</u>
INDUSTRIAL BUILDINGS	Factories Warehouses	Survey must be made 2 lbs. per sq. ft. per day
COMMERCIAL BUILDINGS	Office Buildings Department Stores Shopping Centers Supermarkets Restaurants Drug Stores Banks	1 lb. per 100 sq.ft. per day 4 lbs. per 100 sq.ft. per day Study of plans or survey required 9 lbs. per 100 sq.ft. per day 2 lbs. per meal per day 5 lbs. per 100 sq.ft. per day Study of plans or survey required
RESIDENTIAL	Private Homes Apartment Buildings	5 lbs. basic & 1 lb. per bedroom 4 lbs. per sleeping room per day
SCHOOLS	Grade Schools High Schools Universities	10 lbs. per room & 1/2 lb. per pupil per day 8 lbs. per room & 1/2 lbs. per pupil per day Survey required
INSTITUTIONS	Hospitals Nurses Homes Homes for Aged Rest Homes Prisons	25 lbs. per bed per day 5 lbs. per person per day 5 lbs. per person per day 5 lbs. per person per day 5 lbs. per person per day
HOTELS, ETC.	Hotels - 1st Class Hotels - Medium Class Motels Trailer Parks	3 lbs. per room and 2 lbs. per meal per day 1 1/2 lbs. per room and 1 lb. per meal per day 2 lbs. per room per day 6 to 10 lbs. per trailer per day
MISCELLANEOUS	Veterinary Hospitals Industrial Plans Municipalities	Study of plans or survey required

In terms of efficiency, curbside collection yields the highest productivity.

Table 5-5 compares curbside collection to backyard collection in collection cost per ton for four cities, clearly indicating savings of 50 to 55 percent by using curbside rather than backyard collection.

TABLE 5-5

COST FOR ONCE-A-WEEK COLLECTION USING TWO-MAN CREWS, BY POINT OF COLLECTION AND INCENTIVE SYSTEM, IN FOUR CITIES, 1973 *

City	Incentive system	Point of collection	Cost per ton †	Percent difference
1	task	curb/alley	\$ 9.53	
2	task	backyard	19.26	51
3	8 hours	curb/alley	8.72	
4	8 hours	backyard	18.41	55

* Source: ACT SYSTEMS, INC. A study of collection productivity using various collection methodologies. Unpublished data.

† Labor rates for the cities have been normalized to permit intersystem comparisons; therefore, these figures do not reflect actual collection costs.

*Note: Twice-a-week collection is required in Florida.

Certain citizens will express a preference to receiving backyard collection even though it costs more. An evaluation of the true cost difference between backyard and curbside collection should be performed so that the implications of the more costly service option is realized.

Special service arrangements should be made for the aged and handicapped where curbside collection is used.

On the basis of increased cost efficiency, productivity, and decreased collections injuries, the Environmental Protection Agency and the Department of Environmental Regulation recommend the use of curbside collection.

- 5.2.6 Separate Collections. Bulky items, such as stoves, refrigerators, large furniture, street debris, engine blocks, tree trunk sections, tree stumps, etc., often require the establishment of separate collection procedures.

Collection of bulky items along with other refuse using compaction vehicles and regular crews requires increased time and increased injury hazards.

Other alternatives for collecting bulky items are:

- a. Request, or call-in system in which the homeowner calls the collection agency to request that the item be picked up, and the agency sets the date it is to be collected by a separate bulk pickup crew.
- b. Operation of separate, defined routes comparable to the solid waste routes, designed to cover the whole city in a designated time period, usually once per week.
- c. The resident sets out the bulky item and the refuse collection crew reports that it is there for pickup by a separate bulk-pickup crew.

BULKY WASTE COLLECTION ADVANTAGES AND DISADVANTAGES*

Collection with Other Refuse

"This system requires that the compaction vehicles be capable of handling the items and that the crew be able to lift them. It would not be feasible for one man operating a side-loading vehicle to collect a refrigerator. But the task would be a reasonable one for men using a rear-loading truck having a large enough hopper. The primary advantage of this system is that it is more economical than having a separate crew to collect bulky items. A disadvantage is that it does not lend itself to the charging of a fee for bulk pickup.

Request of Call-in System

"This system has several advantages. The collectors need only go where there are pickups to be made, and proper scheduling makes it possible to concentrate pickups in compact areas. The result is an efficient system with good utilization of the collector's time. It also may very easily incorporate a pickup fee to cover collection costs. However, this system has serious drawbacks in inner-city areas where there are a large number of items set out to be collected and a lack of cooperation by the residents in requesting pickup.

Periodic Bulk Collection Along Defined Routes

"This system works very well in inner-city areas where there are many pickups close together. But in areas where pickups are more scattered, this system can be wasteful since collectors must traverse streets where there is nothing to collect. Therefore the efficiency of the system varies according to the type of district in which it is used. A disadvantage of this method of bulk collection is that it is difficult to assess fees for the service.

Collection Crews Report Items, Separate Crew Collects

"This alternative requires the use of radio communication, otherwise bulky items could sit outside for more than 1 day. Also, the sporadic reports from the refuse collectors are not likely to result in efficient routing of bulk-pickup vehicles. However, this system does insure the pickup of all bulky items.

Conclusions

"The selection of the method of bulky item collection must be based upon the characteristics of the solid waste collection system (crew size and truck type) and the nature of the area being served (inner city or suburban, and income level). In any case, it is a service which must be provided."

*Decision-Makers Guide in Solid Waste Management, U.S. Environmental Protection Agency, Office of Solid Waste Management Programs, 1974, page 53.

- 5.2.7 Collection Recommendations. In addition to the preceeding sections regarding the basic elements of a collection system, the Department also makes the following recommendations:
- a. Solid waste collection systems should be operated in a manner designed to minimize fuel consumption and provide safe and efficient collection, to include, but not be limited to the following procedures:
 - a. Residential solid waste containers which are serviced manually should be placed at the curb or alley for collection. (The extra expense of backyard collection should be borne by the residents requesting such service).
 - b. Collection routes should be designed to minimize driving distances and delays. It is recommended that existing collection routes be re-evaluated to affect overall cost savings.
 - c. All vehicles should receive regular maintenance. Tire condition should be checked daily and kept at recommended pressures.
 - d. When conditions permit, collection of residential solid waste should be conducted no more frequently than twice each week to conserve fuel. Multi-family dwellings of more than five (5) units may require more frequent collection.

- e. Compactor trucks should be used to reduce the number of trips to the solid waste processing facility or disposal site.
- f. Records should be maintained detailing all costs (capital, operating and maintenance) associated with the collection system. These records should be used for scheduling maintenance and replacement, for budgeting, and for system evaluation and comparison.
- g. A safety manual should be provided for use by solid waste collection employees. Prior to assignment of a collection task, all solid waste collection personnel should receive instructions and training in safe container and waste handling techniques and in the proper operation of collection equipment.
- h. Personal safety devices should be provided to collection employees.
- i. Scavenging should be prohibited at all times to avoid injury and to prevent interference with collection operations.
- j. When conducting manual carryout collection, a rigid, leakproof tote-barrel should be used to minimize the potential for physical contact between the collector and the solid waste or the liquids which may be present.
- k. The collection system should be reviewed on a regular schedule to assure that environmentally adequate, economical and efficient service is maintained.
- l. An accurate accounting system and rates for service should be established by the public agency and evaluated at such intervals so as to assure that the collection system is operated in a financially sound manner and self supporting where possible.
- m. Excluded materials - the scope of service provided by the collection system is intended to serve the needs of dwelling units, eating establishments, operating businesses and commercial establishments. Solid waste not considered to be within the scope of the municipal service provided: rock, scrap building materials or other trash resulting from construction, remodeling or destruction by fire. General cleanup of vacant or improved property, trees, brush and/or debris cleared from property in preparation for construction or occupancy should not be collected and removed by the collection system. These materials should be removed and disposed of at the expense of the owner or developer, or in accordance with local regulation.

- n. Industrial wastes resulting from manufacturing or processing operations, including waste from food and vegetable produce houses, poultry dressing establishments, meat, fruit and vegetable processing and packing plants, are not normally a municipal collection function. They should be collected and disposed of at the expense of and by the owner or occupant of the building, business or premises where such waste originates in the manner prescribed by all applicable local and state regulations.
- o. Source separation and separate collections for resource recovery or recycling materials are desirable practices in service areas where resource recovery or recycling is not yet in operation, provided that favorable market conditions exist to warrant such action.
- p. Franchise territories for private collectors should be exclusive (non-overlapping).

5.2.8 Rural Collection System Guidelines. Rural collection systems are necessary because they provide an alternative to indiscriminate open dumping and littering. Regular house-to-house, roadside collection or a rural containerized collection system should be provided for all residents where economically feasible.

The alternatives in rural collection systems are:

- a. House-to-house collection using conventional rear-loading or side-loading packer trucks.
- b. Roadside collection of disposable containers using rear-loading or side-loading packer trucks.
- c. Strategically located disposal stations using large capacity "roll-off" containers or open semi-trailers at elevated platforms or loading ramps.
- d. Containerized system using rear-loading packer trucks.
- e. Containerized system using front-loading packer trucks.
- f. Combination of the above systems.

5.2.8.1 House-to-house Collection. As the density of housing decreases, the time required to collect solid waste from a given number of houses increases. In rural areas,

the cost of house-to-house collection is more than most rural home owners are willing to pay.

5.2.8.2 Roadside collection of disposable containers is the least expensive method of house-to-house collection. It permits a high level of scheduled service to the rural resident for which user charges can be established. Disadvantages are that the home owner must cooperate in setting out containers and litter may result from tearing of containers. Also, the system may be time consuming and costly to utilize in isolated areas.

5.2.8.3 Large capacity disposal stations. These are large capacity disposal containers that can take several equipment configurations.

- a. Semi-trailers (50 to 75 cubic yard capacity) with open tops and situated at loading ramps.
- b. Self-packing semi-trailers with self-contained power units.
- c. Open-top, roll-off containers (usually 30 to 40 cubic yard capacity) which are transported by tilt-type hoist trucks.
- d. Stationary compactors connected to roll-off containers.
- e. Self-packing, roll-off containers with remote power units and transported by tilt-type hoist trucks.

The capital expenditure for large capacity disposal stations without compactors is approximately equal to a front-loading container system. The operating cost is much greater because the waste is hauled uncompacted to the disposal site. This requires more trips per ton of waste. When compactor units or self-packing units are purchased, the capital costs become quite high, but the increased cost may be offset by fewer trips.

Large capacity disposal stations, because they are a fixed installation, require considerable site preparation and a permit from the Department of Environmental Regulation. A loading ramp is needed with a paved or graveled dumping area. Also needed is a concrete slab for container support, concrete retaining wall, fences, and separate access road for collection vehicles. A power source is also needed if compaction units are employed. Weight limits of roads, bridges and culverts must also be taken into consideration.

Rear-loading container system - rural. The rear-loading

container system is similar to the front-loading container system; however, this system also allows for operation of house-to-house collection.

Side-loading container system - rural. Similar to rear-loading system, only less container capacity as a rule.

- 5.2.8.4 Front-loading container system. The front-loading container system has several advantages over the rear-loading container system. The front-loading collection vehicle requires only one man for operation; the rear-loading collection vehicle requires two. Selection of container site for rear loaders is more critical because rear-loading vehicles must back up to the container for dumping. The time required to empty a rear-loading container is much greater than for a front-loading container.

A front-loading container system offers the most user convenience and least service cost per unit.

The greatest disadvantage of the front-loading container system is that the initial capital investment cost may be quite high. The system can only be financed by user charges with difficulty, except for commercial services. The container sites must be properly maintained, to prevent unsanitary conditions from developing.

The characteristics of front, rear and side-loading rural container systems are listed in Table 5-6.

Any combination of the above rural systems can also be used. As in any collection system, the costs versus the benefits must be carefully weighed before starting a program that might prove inadequate for the particular service area.

In a rural containerized collection system, there are many complicated aspects which must be solved. Some of these are:

- a. Selection of collection equipment.
- b. Identification and design of container locations.
- c. Determining number and size of container units.
- d. Selection of collection routes.

- 5.2.8.5 Identification and design of container locations. Container locations should naturally be convenient for the user and accessible for servicing.

Locations should be chosen near existing unauthorized dumps, when convenient, because a pattern for using these locations for waste disposal has been established. Other possible container locations are:

- | | |
|---------------------|-------------------------------|
| a. Schools | e. Community centers |
| b. Service stations | f. Parks and recreation areas |
| c. Grocery stores | g. Litter barrel sites |
| d. Churches | h. Road intersections |

- 5.2.8.6 Site Requirements. The container site itself should be large enough to permit waste unloading, container servicing and vehicle turn-around without causing hazardous traffic conditions. The Florida Department of Transportation should be contacted regarding requirements on ingress and egress for roadside facilities. Signs should be posted giving information regarding materials accepted and storage areas for bulky items should be carefully planned.

Naturally, the site should be accessible in all weather conditions; it should be sloped to prevent drainage problems; drainage ditches or drainage pipes may be necessary. The site should be surfaced, preferably asphalt or concrete to avoid muddy conditions and erosion.

Data for each site should be kept by the local authority with maps showing collection routes, container sizes and the location of all sites in relation to housing. The system should be reviewed regularly to assure that environmentally adequate, economical and efficient service is maintained.

A useful form in keeping up with container sites is shown in Figure 5-7. All rural containerized collection systems should use similar forms to improve the efficiency of their operation.

- 5.2.8.7 Determining number and size of container storage units. Determining factors:

- a. The number of people using the container.
- b. The quantity of waste generated per capita.
- c. The frequency of collection (minimum two per week).

- 5.2.8.8 Collection Routes. Collection routes must be established so that all containers are collected or emptied on schedule with a minimum expenditure by the operating

authority. This requirement can easily be met by some, with a single route to run; but, routing becomes increasingly difficult with larger size operations. It is advisable to seek professional help in designing such operations.

5.2.9 Residential and commercial collection equipment requirements. There are many types of collection vehicles available. The three main groups of collection vehicles are front loaders, side loaders and rear loaders. In addition to these specialized types of collection vehicles, the open dump truck also serves a useful purpose in solid waste collection.

5.2.9.1 Open dump trucks. Open trucks are less expensive to purchase than specialized, packer type collection vehicles. They usually require a crew of three or more, and are used to collect bulky items which are too large, or too heavy to fit into standard collection vehicles. Open trucks must be equipped with a top cover to avoid the flowing of waste so as not to violate the Florida Litter Law (Chapter 403.413) and the Florida "Tarp Law" (Chapter 316.198, F.S.).

Many collection systems use an open dump truck along with a tractor front-end loader or "clam" type hydraulically operated mechanism for collecting large piles of debris, such as tree trimmings.

A specialized version of the open dump truck has appeared on the market. Used as an auxiliary collection vehicle, it has a capacity of two to three cubic yards which can serve nine or more residences before unloading into a standard rear loading collection vehicle. This collection method is often called "satellite" collection; many cities have experienced increased savings with this, and other innovative systems.

5.2.9.2 Front loading packers. Front loaders are trucks which range in size from 21 to 52 cubic yards. These trucks collect bulk containers usually varying in size from 1 to 10 cubic yards. The application of front loaders in residential collection systems is usually in handling apartment buildings. Satellite systems such as trailer trains or special collection transfer vehicles (such as a bulk container adapted to a pick-up truck) are sometimes used in single family residential collection.

5.2.9.3 Rear loading packers. Rear loaders are trucks which range in size from 10 to 31 cubic yards. These collection vehicles are equipped with a loading hopper connected to the rear of the body. Normally, the loading hopper is waist high or lower to permit loading

without excessive physical strain. The waste is swept into the body of the truck by a hydraulically operated packer blade and then ejected at the disposal site by an ejection blade. The rear-loader is a complex piece of equipment, often combined with an auxiliary engine to operate the hydraulic mechanisms. To avoid serious accidents and to properly maintain the rear-loader requires well trained workers.

A specialized rear-loader is also now available. No hydraulics are used, instead a mechanically driver, rotating cylinder with screw-like ridges, compacts the solid waste. To unload, the rotation of the cylinder is reversed.

Many rear-loaders on the market have the capability of picking up bulk containers, ranging in size from 1 to 6 cubic yards, thus enabling the same truck to be used for residential and commercial pickup.

Side loading packers range in size from 5 to 37 cubic yards. The smaller versions are sometimes used as satellites to larger rear loaders. Side loaders are of simpler construction and do not weigh as much as rear loaders. Their small size and light weight makes them ideal for light-duty roads.

Special mechanisms can be adapted to side loaders enabling the pickup of large containers (usually up to 80 gallons) that are wheeled out to the curb for pickup.

- 5.2.9.4 Roll-off collection units. Another type of bulk container is the roll-off unit. These range in size from 10 to 50 cubic yards. These can be open-top or closed containers which can be connected to stationary packers. A special truck used to winch the roll-off units is generally used to service large commercial and industrial accounts. They can also be used in solid waste transfer systems.

There are a few specialized collection vehicles. The Gulf Bay Retriever is a one man operation which uses disposable plastic or paper bags. A telescopic type pickup arm with clam like jaws is used to retrieve the bags. There are others; non-stop collection vehicles, special modular collection vehicles and side-loading and rear-loading mechanisms for residential pickup.

- 5.2.10 Selecting Collection Vehicles. The type of collection vehicle selected will be determined partly by the kinds of customers served and the demands of these customers. Bulk container systems are most efficient in servicing

apartments and commercial-industrial accounts. Side loaders are generally most efficient in curbside operations and rear loaders are generally most efficient in high density areas and backyard systems.

To determine the correct size collection vehicle requires a knowledge of waste loads, street patterns, pickup locations and densities, collection route pickup time, and haul distance to the disposal site or resource recovery facility.

The quality and capabilities of collection vehicles vary among manufacturers. Almost all collection vehicle manufacturers sales representatives will assist in choosing the right type of equipment; however, the best check on the quality of the equipment is the testimonies of other purchasers.

Listed below are some questions that must be answered prior to purchasing a collection vehicle.

- a. What kind of routine maintenance is required;
- b. How often do major parts have to be repaired or replaced;
- c. What are the costs of these major parts;
- d. Who will perform major repair;
- e. Where can routine maintenance and major repair parts be obtained and what kind of delivery schedule can be expected;
- f. What kind of training is necessary for the purchaser's personnel to perform major repairs;
- g. How complex is the normal operation of the vehicle;
- h. What type of operator's training program will be required;
- i. Who will train the operators and what will be costs of operator training;
- j. What are the expected operational and maintenance costs per ton; per minute of operation; per mile of operation; per collection point
- k. What kind of trade-in value can be expected.

5.2.11 Labor. The Solid Waste Collector. The manual solid waste collector has a dirty job and is looked upon with contempt by most people. At the end of each day he knows his is a dirty job by the sight and the smell of his clothes. Solid waste collection is a hazardous occupation. National Safety Council information indicates that the frequency rate of disabling injuries for municipal solid waste collection personnel is almost three times as great as those incurred in underground mining operations. He must usually walk 10 or more miles per day, lift in excess of 5000 pounds during the day, repeatedly get on and off collection vehicles, throw levers, push buttons, keep his eye on traffic, avoid vicious dogs, and maintain a strict schedule. He must be strong, alert, have physical dexterity and have a good sense of balance. The clothes he wears, his attitude toward customers, his on-the-job performance and the general attitude reflect on his employer. In return, he is usually paid the lowest wages on governmental pay scales.

5.2.12 Labor Administration. As was pointed out in the organizational section of these guidelines, the administrator or director of a public solid waste collection system may be anyone, from an appointed member of the city council, to a full time professional director.

The director of a solid waste collection system normally performs the following types of activities:

- * Prepares an annual operating budget for approval by the city council
- * Determines the cost accounting procedures used and approves routine fund disbursements
- * Prepares periodic reports for the city council
- * Recruits, selects, and fires employees from supervisors to collectors. Sometimes, employees selected and fired must be confirmed by the entire city council
- * Responds to complaints by customers
- * Periodically inspects field operations
- * Provides guidance and direction to supervisors

5.2.13 Supervisors. In small city operations, the supervisor may be the driver of the collection vehicle. Large city or regional operations may have an overall system director who performs a general supervisor function. The primary function of the supervisors is to maintain

the daily operating schedules. His duties are:

- a. Provide for the training for vehicle drivers, collectors and equipment maintenance crews
- b. Determine the operational reliability of equipment including routine maintenance, major repair, or replacement requirements
- c. Determine the physical conditions and mental alertness of collection crews on a daily basis
- d. Rearrange routes and collection crews to obtain maximum utilization of available manpower and equipment
- e. Determine and evaluate collection crew work performance
- f. Enforce equipment operations and collection safety practices
- g. Respond to customers
- h. Maintain necessary records related to operational practices
- i. Report performance and operations problems to the director

5.2.14 Collection Route Systems. When all of the elements of a solid waste collection system have been combined, then the collection routes must be established. Route layout studies may be conducted as a prerequisite in determining the size of the equipment and collection crews. Route layout studies are also used to find the most efficient and least expensive way to use existing equipment and collection crews. Route layout studies must also be used to reevaluate and realign routes whenever new disposal sites or transfer stations are being considered.

Collection routing can be a complex and difficult task. To analyze all the possibilities would be impractical and time consuming. The use of mathematical models and/or computer programming is complex and time consuming. The Environmental Protection Agency's Office of Solid Waste Management Programs has been conducting studies on solid waste storage and collection systems for the past several years. They have published a report on heuristic routing, which is the first of a series of reports which will include:

- a. A five-stage improvement process for solid waste collection systems.
- b. Management information systems for residential solid waste collection (COLMIS).
- c. Policies and methodologies for solid waste collection.
- d. Districting and route balancing

(Copies of these publications are available from the Environmental Protection Agency's Office of Solid Waste Management Programs in Washington, D.C.; or from the Department of Environmental Regulation, Solid Waste Management Program in Tallahassee).

The objective of any collection system is to pickup the waste on time, and haul it away. But, this is the only objective in many cases; as long as it is picked up, why fuss? Why carry out unnecessary studies into productivity and cost analysis? The truth is, the productivity of a collection system depends on a constant data flow from a number of variables.

EPA has developed a simple five step improvement process for greater productivity and cost savings. The process has been successfully tested and used in cities such as Akron, Ohio which improved service and saved \$2.2 million; Little Rock, Arkansas, a savings of \$200,000; Portland, Maine doubled collection frequency and still saved \$30,000 annually.

The five steps of this improvement program are:

1. Review existing policies and methodologies and alternatives to these. For example:
 - What is the point of collection? Should it change?
 - Can we use plastic bags?
 - Is my crew size too large?
 - Is there modern equipment that can cut my costs?
 - Should I consider separate collection of newsprint for resource recovery?
2. Determine the optimum assignment of the daily collection routes to processing and disposal facilities (macro-routing).

3. Perform districting and route balancing to determine a fair day's work and divide the collection areas into equal workloads for each crew.
4. Determine the path or "route" the collection vehicle is to follow as it collects waste from each service in a specified area (micro-routing).
5. Implementation of changes.

"These steps should be performed in the order listed except that the route design phase of Step 3 is performed simultaneously with Step 4. Implementation should be considered throughout all steps".

Collection productivity studies have been conducted in many cities with a result of savings in every case.

The National League of Cities, United States Conference of Mayors, National Solid Waste Management Association, American Public Works Association and other public and private organizations have extolled the importance of collection productivity. Publications regarding this subject may be obtained by writing these organizations.

5.2.15 Occupational Safety in Collection. Solid waste collection is a hazardous occupation. The causes of disabling injuries are varied, but the National Safety Council statistics show the major cause (88%) to be unsafe acts. The proper training of solid waste collection personnel is essential to prevent accidents which cause disabling injuries.

The Florida Department of Environmental Regulation has training films and manuals on safety in solid waste collection and disposal available for educating solid waste systems personnel. The Department encourages the use of such aids in training solid waste collectors and solid waste disposal facility operators. These training aids may be obtained by contacting the state solid waste specialist located in your respective district.

5.3 Transportation. Barge haul, railhaul, truck transport. With many dumps being closed because of unhealthy and environmentally unsound operating methods; with land used for landfill becoming increasingly scarce; and with the opening of regional resource recovery facilities, there will be an ever increasing demand for transportation of solid waste.

Regional solid waste collection and disposal systems will

require special attention to transportation of materials. Whether the materials are solid waste going to the resource recovery facility or recycled and recovered resources headed to factories, transportation by rail, barge or truck will be one of the most important aspects of the system.

- 5.3.1 Transfer Stations. A transfer station is generally defined as a fixed facility used for removing solid waste from collection vehicles and placing it into long-haul vehicles.

To justify the use of a transfer station, the total cost of collection, transfer and disposal must be less than the total cost of collection and direct haul to disposal.

The design and operation of a properly run, efficient transfer station is not an easy task. Assistance should be sought from a solid waste consultant, the Environmental Protection Agency or the Department of Environmental Regulation in planning a transfer system. The EPA has some excellent publications regarding transfer stations.

The Department makes the following recommendations regarding transfer stations:

- a. When the distance or travel time from collection routes to disposal sites is great, transfer stations should be used when cost effective.
- b. The economic feasibility of rail and barge transport should be considered in the transfer of solid waste and materials separated for the purpose of recycling.
- c. A special storage area for items which may be recycled should be considered when cost effective. Special provisions should be made to handle bulky items.
- d. Basic considerations related to transfer station need and site selection are: 1) traffic patterns, 2) zoning, 3) proximity to collection routes, 4) proximity to disposal or processing site, 5) volume handles, 6) peak load storage, and 7) types of vehicles.
- e. Transfer stations should be equipped with a scale to weigh incoming vehicles especially if user-fees are levied, since estimating fees on a volume basis can prove very inequitable.

6.0 HAZARDOUS WASTES.

The management of hazardous wastes is an area of relatively new emphasis in the United States. Due to the increases in industrial production, stricter air and water pollution controls, ocean dumping restrictions, and material bans such as DDT, aldrin, dieldrin, and proposed banning of chlordane, heptachlor, and polychlorinated biphenyl oils (PCBs), the amounts of toxic and hazardous waste destined for land disposal will be greater than ever.

Serious insults to the environment and hazards to public health have resulted from the improper handling and disposal of hazardous waste. Explosions, caustic and highly toxic fumes, sprays and splashes at landfill operations have caused numerous injuries to landfill personnel - even death.

The list of serious problems caused by improper management of hazardous waste is considerable. Only through a comprehensive program of control and regulation can hazardous waste management become effective.

Work in the area of hazardous waste management in Florida formally began in 1975 by providing technical assistance in the treatment and disposal of various hazardous wastes on a case-by-case basis. The number of cases has now increased, but recent EPA figures indicate that we are not really receiving the full impact of the hazardous waste problem. We are now planning for a regulatory program for the management of hazardous waste as envisioned by the U.S. Environmental Protection Agency.

Other states, for example California and Oregon, have already passed legislation providing for regulatory programs in hazardous waste management. Special treatment and disposal sites and haulers of hazardous waste do so under permit, and in some states, the generators of certain designated hazardous wastes are required to pay a fee for all hazardous wastes not reprocessed or recycled for reuse. Within the next two years, Federal legislation will require all states to provide a regulatory program in hazardous waste management.

6.1 Current Department of Environmental Regulation Policy. Chapter 17-7.02(9), rules of the Department of Environmental Regulation, defines hazardous waste as:

"(9) "Hazardous Wastes" are materials or combinations of materials which require special management techniques because of their acute and/or chronic effects on air and

water quality; on fish, wildlife, or other biota; and on the health and welfare of the public. These materials include, but are not limited to, volatile, chemical, biological, explosive, flammable, radioactive and toxic materials."

Federal hazardous waste legislation, Section 1004 of House Bill #14496 defines hazardous waste as:

"(5) The term 'hazardous waste' means a solid waste or combination of solid wastes, which because of its quantity, concentration, or physical, chemical, or infectious characteristics may -

(A) cause, or significantly contribute to an increase in mortality or an increase in serious irreversible, or incapacitating reversible, illness; or

(B) pose a substantial present or potential hazard to human health or the environment when improperly treated, stored, transported, or disposed of, or otherwise managed."

The present authority regarding hazardous wastes comes from Chapter 17-7.04(3), rules of the Department of Environmental Regulation (DER). In the prohibitions section, it is stated that:

"(3) Hazardous Waste: The land disposal or incineration of hazardous waste which would create a condition harmful to the environment, shall at the owners' expense, be rendered safe and sanitary prior to delivery to the disposal facility. Should a hazardous waste be of such a chemical composition that it cannot be rendered innocuous, the producer of such wastes must confer with appropriate authorities or the Department to determine a safe disposal or storage method."

When providing technical assistance for approval of the disposal of hazardous waste, it is the intention of DER to provide safe and environmentally sound methods of disposal,

Whenever a hazardous waste is considered for disposal, it is the Department's policy to:

- (a) Use the material for its originally intended purpose, whenever possible.
- (b) Send the material back to the manufacturer for recycling - reuse whenever possible.

- (c) Perform one or more of the various treatment methods available to neutralize or render the material innocuous.
- (d) Send the material to a company specializing in the treatment/disposal of hazardous waste. Such companies, when located in Florida, should meet the approval of the Department.

6.2 Disposal. With our ever-increasing concern over the quality of our surface and subsurface waters, we seriously doubt the environmental adequacy of land disposal of hazardous waste unless special precautions are taken.

The Environmental Protection Agency has defined a specially designated landfill as:

"...a landfill at which complete long term protection is provided for the quality of surface and subsurface waters from pesticides, pesticide containers, and pesticide-related wastes deposited therein, and against hazard to public health and the environment. Such sites should be located and engineered to avoid direct hydraulic continuity with surface and subsurface waters, and any leachate or subsurface flow into the disposal area should be contained within the site unless treatment is provided. Monitoring wells should be established and a sampling and analysis program conducted. The location of the disposal site should be permanently recorded in the appropriate local office of legal jurisdiction. Such facility complies with the Agency Guidelines for the Land Disposal of Solid Wastes as prescribed in 40 CFR Part 241."

A landfill engineered to the above requirements would be acceptable for the disposal of hazardous and toxic wastes.

6.3 Operation Safety in Disposal of Hazardous Wastes.¹ Certain precautions are necessary to protect the health and safety of disposal facility personnel as well as others using the facility or residing nearby.

Facility personnel should be knowledgeable of the characteristics of the materials being handled. Workers should be informed of the risks to themselves and others and be provided with special instructions and equipment for safe handling of hazardous wastes. There should be on-the-job supervision.

6.3.1 Response to Dangerous Situations.

- (a) An accident prevention and safety program should be established and emergency plans prepared.
- (b) Communications should be available, and emergency numbers posted (fire and medical).
- (c) Protective clothing should be provided as needed for safe work with chemicals (gloves, respirators, goggles, coveralls, etc.).
- (d) Special precautions should be taken during unloading of trucks to protect site operators and truck drivers.
- (e) Washing facilities should be readily available.
- (f) Emergency eye wash water should be provided and kept close by.
- (g) Hands should be washed before smoking or eating.
- (h) Lunches, drinking water, and tobacco should be kept away from chemicals.
- (i) Facilities for showering and changing clothes after each day's work should be provided.
- (j) Work clothes should be washed separately and not taken home for laundering.
- (k) Tools or other items contaminated with hazardous chemicals should not be taken from the site until after decontamination.
- (l) Materials that cannot be decontaminated, should be destroyed.
- (m) Complete physical examinations of new employees and regular medical checkups are advised for personnel working at a hazardous waste disposal facility.
- (n) The physician should be alerted to the kinds of materials the employee works with.

6.3.2 First Aid Information.

- (a) Medical supervision should be available.
- (b) First aid measures should be known.

- (c) Cleanup materials spilled on the body immediately.
- (d) Obtain services of a physician.

6.3.3 Common Industrial Hazards - A Summary.²

- (a) Caustics. Common Materials; sodium, potassium, and calcium hydroxides. Health and safety implications; corrosive action on all body tissue, internal and external. Emergency action; wash contacted area with plenty of water. See physician. Other hazards; large amount of heat evolved when mixed or diluted with water; corrosive to cloth and some metals; i.e., aluminum, tin, lead, and zinc.
- (b) Acids. Common Materials; usually sulfuric, hydrochloric, nitric, boric, chromic acids. Health and safety implications; will cause severe burns on all body tissue; inhalation of acid vapors or oxides of sulfur or nitrogen extremely dangerous. Emergency action; remove patient from contaminated area, wash contacted tissue with water, see physician. Other hazards; reacts with most metals, gives off hydrogen and certain oxides, may cause fire with contact of organic material, heat evolved when water is added.
- (c) Oils. Common Materials; waste oil or tank bottoms. General hazard; fire hazard when exposed to heat or flame.
- (d) Waste Water and Washes. Common materials; variable, depending upon process being cleaned and chemicals used in cleaning process. Health and safety implications; hydrogen sulfide from sour water is both an irritant and asphyxiant, dangerous in high concentrations. Phenol in phenolic water is corrosive to tissue and is easily absorbed, where major damage can occur internally.
- (e) Sludges. Sludges should be considered by their major component; i.e., caustic, acid, or oil.
- (f) Solvents and Paints. Common materials; variable types of petroleum based or heavy metal content materials. Health and safety implications; lead poisoning with lead-based paints, hazard usually connected with vehicle substance used. General hazard; fire hazard when exposed to heat and flame.

- (g) Chemicals. Common materials; miscellaneous types, some of which are listed below. Health and safety implications and general hazards; peroxides are an irritant to tissues, there is dangerous fire and explosion hazard. Sulfides have an explosion and fire potential and will emit hydrogen sulfide upon reaction. Kerosene is an irritant if ingested; fire hazard when exposed to heat and flame. Chromium compounds (chromates) are corrosive to tissue and are dangerous in high concentrations. Beryllium compounds are extremely dangerous under any condition. Pesticides, depending on formulation, can be extremely dangerous.

¹ Taken from "Guidelines for Hazardous Waste Land Disposal Facilities," California State Department of Public Health, January, 1973.

² For more detailed information on industrial processes and toxicology of chemical substances, other references should be consulted. Examples of such references include:

Recommended Methods of Reduction, Neutralization, Recovery or Disposal of Hazardous Wastes, Environmental Protection Agency, September, 1973.

Merck Index, 8th Edition; Merck & Co., Inc.; Rahway, New Jersey, 1968.

Dangerous Properties of Industrial Materials, 3rd Edition, N. Irving Sax, Reinhold Book Corporation, New York, New York, 1968.

Condensed Chemical Dictionary, 8th Edition, Gessner G. Hawley, Van Nostrand Reinhold Co., Princeton, New Jersey, 1971.

"Chemical Safety Data Sheets," Manufacturing Chemists Association, Washington, D.C.

7.0 SPECIAL WASTES.

- 7.1 Abandoned Vehicles. A survey should be conducted to determine the number and location of the vehicles. Agreements or contracts with scrap dealers or vehicle collection companies can be negotiated to provide a collection service whereby the pickup expense is offset by the salvage value. Another method involves a privately owned portable car crusher moving to the local storage area, crushing, and transporting the vehicles to a scrap dealer or processing plant, providing a certain minimum number have been accumulated. If local transport capability is available, car bodies can be crushed by a bulldozer or other tracked vehicle which is usually part of city or county equipment.

A cooperative venture between several municipalities could provide the equipment at a central point to cope with the special problems of abandoned vehicles.

The booklet "An Abandoned Automobile Plan for Florida" can be used to provide alternative procedures to assist in implementing the section on abandoned vehicles in the program (available from the Department of Environmental Regulation, Tallahassee).

- 7.2 Agricultural Waste. There are five sources of agricultural waste whose handling and disposal can be problematic. These include human waste from the rural population, crop residues, waste from rural industries, agricultural chemical residues, and dead animals.

The largest single problem in confinement production involves manure. The four steps in management of manure are; collection, processing, storing, and utilization or disposal. Local practices for use and disposal of manure should be developed in accordance with the guidelines and recommendations of the Institute of Food and Agricultural Science of the University of Florida or your county agricultural agent.

Perishable fruits and vegetables that are left in the fields to rot can breed vectors which cause disease. After the final harvest the fruits and vegetables need to be plowed into the ground.

The concept of recycling and reuse of the large quantities of agricultural solid waste is not new, but the practice now requires more widespread application. Current recommended techniques for consideration are;

- (a) Composting or land spreading.

- (b) Feeding of crop residues to livestock either directly or after processing.
- (c) Rendering of animal carcasses.

7.2.1 Guidelines for the Protection of the Water.

- (a) Manure storage areas should be managed to minimize percolation of water into the soils.
- (b) Application of manures and washwaters to crop lands should be at a rate which is reasonable for the soil, crop, climate, and type of manure.
- (c) Lands that have received animal wastes should be managed to minimize erosion and runoff.
- (d) Animal wastes shall be managed to prevent nuisances in manure storage areas.
- (e) Residues from agricultural practices should be recycled, utilized for productive purposes or disposed of in a manner not to cause vector creation or sustenance, air or water pollution, public health hazards, odors or nuisance conditions.

7.3 Dead Animals.

- (a) The phone number of the pickup service for dead animals should receive wide publicity particularly among law enforcement officers and mobile public agency employees.
- (b) Several disposal options are available;
 - (1) burial in a sanitary landfill,
 - (2) send to a rendering plant (if large),
 - (3) incineration, or
 - (4) small animals deceased on private property should be placed in a plastic bag for collection.
- (c) Dead animals received at the disposal site should be deposited onto the working face at or near the bottom of the cell with other solid wastes, or into a separate disposal area, provided they are covered immediately with six inches of earth to prevent odors and the propagation and harborage of vectors.

- 7.4 Industrial Waste. A survey of local sources and types of industrial wastes would point up the need to determine if they are hazardous, and the various methods of disposal required. Industrial waste producers should be encouraged to explore possible recycling methods or processes either in their own plants or through cooperation with related industries.

Industrial pollution sources are too varied and diffuse to permit detailed listing of the technological means of pollution reduction. In general, the problem is not due to lack of control technology, but rather to lack of application of available technology. The needs of the future are largely matters of industry location with respect to other land uses, and making the best use of topography and meteorology to protect the environment.

In addition to the highly toxic organic wastes such as pesticides, waste products discharged from industry are increasing in number, volume, and complexity at a pace commensurate with our general technological development. They include chemical wastes, petrochemicals, salts, acids, silts, fly ash, and sludges. Many are toxic and methods of removal as well as knowledge of biological effects are only poorly developed. An indication of the complexity of the problem and its potential danger is the fact that new chemical substances with attendant waste products are created for use each year. Protection of water supplies from these growing sources of contamination will require a variety of treatment methods; but the greatest need is removal by in-plant processes to prevent entry into receiving waters.

In most instances biological treatment with trickling filters or an activated sludge process will meet a plant's requirements, but the choice must be made carefully in terms of the type of wastes that are to be treated, their volume and of particular importance, the completeness of the treatment that is required.

Many industrial wastes are compatible with sanitary sewage systems for subsequent treatment in the municipal sewage treatment plant. Generally, such wastes should be governed by local sewer ordinances which regulate the discharge of industrial wastes and usually specify the manner by which the waste may be admitted. Pretreatment may be required to remove toxic substances, flammable compounds, heavy metals, or to adjust pH prior to sewerage.

- 7.5 Sludges. As new sewage treatment plants are planned or modification of existing plants is contemplated, designs should include provisions to accept septic tank pumpings.

The disposal of sewage sludge and septic tank pumpings in a sanitary landfill is considered satisfactory provided the sanitary landfill meets all of the criteria in Chapter 17-7 Part I.

Presently, activated sewage sludge is being disposed of at the land disposal site. Guidelines are being formulated to permit the disposal of treated sewage sludge on the ground via spreading of the sludge. It should be pointed out that sewage sludges have been found to contain unacceptable quantities of heavy metals and other deleterious materials concentrated from the waste water being treated.

- 7.5.1 Two feasible solids disposal alternatives have been developed for water treatment plant sludge processing. One involves incineration of the waste solids with separate recalcination of the calcium carbonate. The other solids disposal alternative involves disposal of the calcium carbonate in sanitary landfills with digestion of the waste solids. The incineration/recalcination alternative is preferable, since chemical costs are significantly less and fewer solids are produced for ultimate disposal.

- 7.6 Used Tires. Problems associated with used tires are; they do not deteriorate rapidly, they are difficult to dispose of and are usually abandoned in the open to collect rain water which becomes a mosquito breeding ground, and they are aesthetically offensive.

At the present time only used tires that can be re-treaded are recycled. Local communities are encouraged to periodically survey sources, to specify proper storage and to encourage use of used tires for other purposes.

Suggested uses are;

- (a) In larger cities or counties tire grinders can be used to produce granular rubber pieces suitable for use as an aggregate in asphalt paving or to facilitate disposal.
- (b) Sports clubs in coastal areas have often cooperated in forming fishing reefs out of properly tied and weighted used tires.
- (c) As a last resort the tires should be landfilled by placing small quantities at the toe of the fill to insure adequate cover.

- 7.7 Waste Oil. Local communities should consider establishing centralized oil collection facilities where the "do-it-yourselfer" can bring waste oil. Arrangements should be made

to have an established waste collection service pick up the waste oil. It is possible for several adjacent communities to pool their waste oil for transport in larger tank trucks to the nearest waste oil refiner provided the overall expenditures do not exceed the salvage value.

Waste oil can cause environmental problems to municipalities when it is disposed of in unacceptable ways such as uncontrolled burning as a fuel, which can result in the emission of lead and other heavy metals; uncontrolled dumping on land, which can result in the contamination of groundwater from leachate or contamination of water ways from runoff; and dumping in water ways, which can result in damage to fresh and salt water marine organisms.

The most serious environmental problem associated with re-refining is the disposal of the sludges and bottoms from the re-refining process. These wastes can be satisfactorily disposed of in a properly managed landfill, provided they are properly neutralized prior to disposal.

In order to control the collection and disposition of waste oil, communities should issue regulations that;

- (a) Govern the operation of a facility to process or dispose of waste oil.
- (b) Require the collection of waste oil.
- (c) Require that all major waste oil generators contract with certified collectors for the hauling of this product.

7.8 White Goods or Bulky Items. Appliance dealers are to be encouraged to cooperate in establishing a sound plan to dispose of used appliances. A survey to obtain the number and location of units will determine if quantities within a reasonable area are sufficient to interest a scrap dealer or processor. A portable car crusher can be used to compact appliances. Many similarities between abandoned vehicles and white goods make it desirable to consider combined programs for disposal. Periodic civic drives to accomplish the removal and recycling of abandoned vehicles and appliances are commendable, but a continuing program backed by dedicated public officials is the best answer.

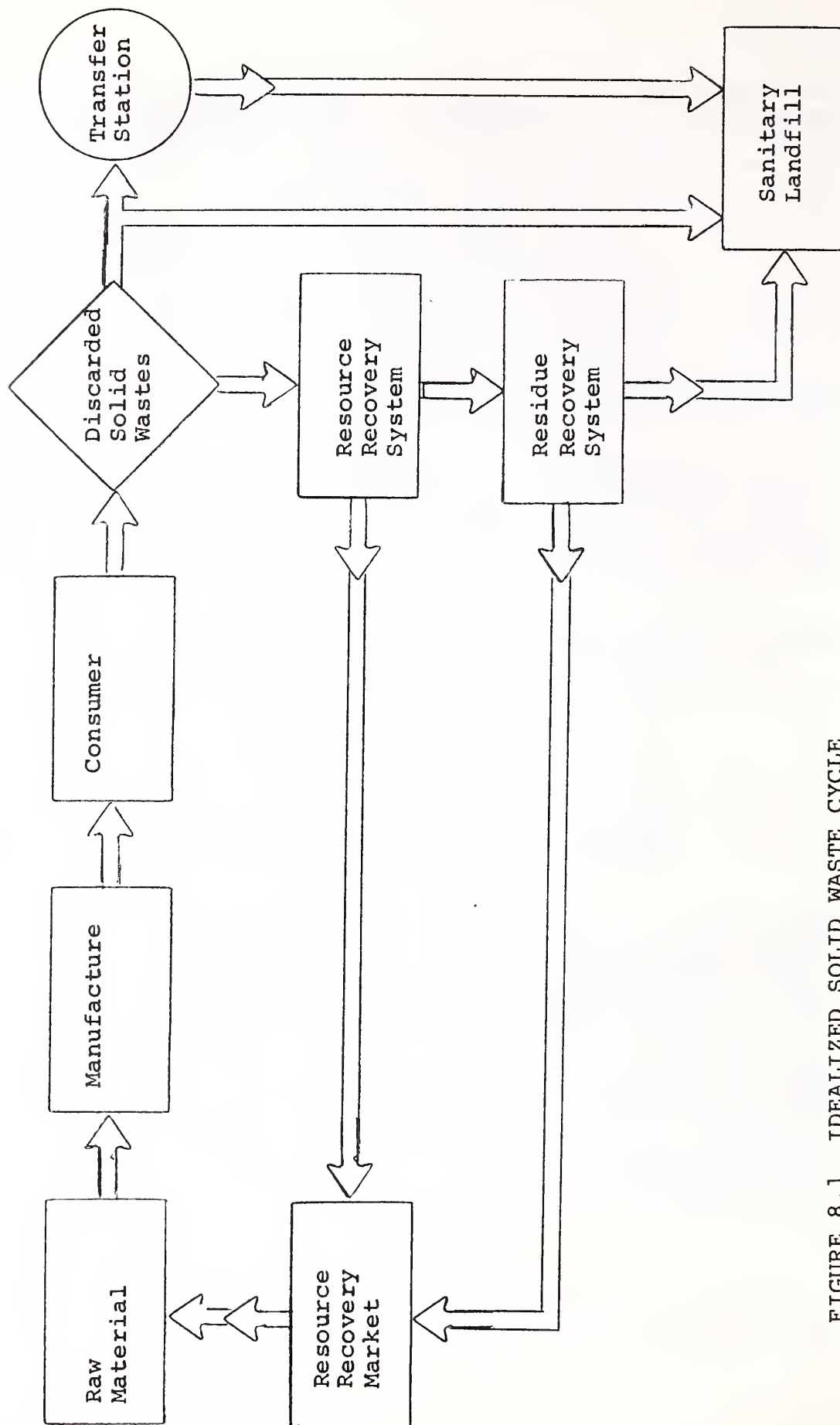


FIGURE 8.1 IDEALIZED SOLID WASTE CYCLE

8.0 RESOURCE RECOVERY SYSTEMS FOR SOLID WASTE MANAGEMENT PROGRAMS.*

The purpose of this section is to provide a qualitative description of available resource recovery options and information concerning the efficiency, environmental impact, and development status of each technology option. This section will help officials decide if systems are available to meet their unique requirements. Data have been drawn from operating histories and field experience of full-scale demonstrations, but due to limited experience in this field, much of the information is based on engineering projections and results of pilot scale testing.

This guide will NOT tell which system to select. There is no generally "best" or most economical recovery technology. Every community facing a resource recovery decision must consider its own unique set of factors when selecting a course of action, such as available markets and local prices, capital and operating cost projections, technological risks, financing and management alternatives related to different systems or considerations. The best choice in some situations may be systems which in other circumstances might seem to be prohibitively expensive or involve greater technical uncertainties. For example, the recovery system with the lowest projected net cost may involve the highest degree of technological risk. The final decision is subject to specific value judgements which each community must make.

The most important factor to remember when assessing a technology is that the systems must be able to produce marketable products. Technology selections should not be made until potential markets have been identified and the market requirements specified. Some communities will find that there is only one technical approach that can simultaneously meet their needs and the requirements of their markets. Most cities, however, will have the flexibility to choose from two or more technologies that meet their market requirements.

The systems described here are categorized as either energy recovery or material recovery. The two are not mutually exclusive since most proposed systems have aspects of both.

* Information in Sections 8.0 through 8.3.4 is excerpted from the Environmental Protection Agency Publication, Resource Recovery Plant Implementation, Guidelines for Municipal Officials, by M. C. Eifert, S. J. Levy, H. G. Rigo; January, 1976, and is used with permission.

8.1 General Considerations for Resource Recovery System Design. The following technical aspects must be considered by a local government when selecting a resource recovery system design:

- (a) Markets for recovered products
- (b) Waste generation (quantity)
- (c) Waste composition
- (d) System reliability
- (e) Plant location
- (f) Land required for the plant site
- (g) Community acceptance
- (h) Plant costs and revenues

These factors, which apply to all technologies, must be considered in the design of any system and are only briefly discussed here.

8.1.1 Markets for Recovered Products. Successful implementation of a resource recovery system depends upon selling the recovered products. Revenues from the sale of recovered products can help to offset the cost of owning and operating the plant; without such revenues, the cost of most resource recovery systems would be prohibitively high.

To be marketable, products reclaimed from energy and materials recovery systems must have qualities that are acceptable to the user. Steam and electricity produced from solid waste are equivalent to those products from other sources. However, refuse-derived-fuels have characteristics that are different from conventional fossil fuels. Some of the more important fuel characteristics are; ash content, higher heating value, corrosiveness, viscosity, and moisture content. Similarly, the quality of recovered materials must be commensurate with user specifications.

For all products derived from refuse, considerations such as reliability of supply and quantity are also important. A higher price can usually be obtained for a certain supply than for an unreliable source. This is particularly true for fuel processing.

8.1.2 Waste Generation (Quantity). The amount of waste that the community generates must be estimated carefully so that the resource recovery plant (and accompanying elements in the total solid waste management system; i.e., transfer stations and sanitary landfills) can be designed to the proper size. An oversized plant will have under-utilized equipment and will cost more than necessary. An undersized plant will not be able to accept the quantity of waste that must be processed.

There are several ways to estimate waste generation quantities. Some of these may appear costly; but, considering the potential costs of over (or under-designing) a plant, estimating waste quantities is an essential and prudent investment. Methods for obtaining these data are discussed below.

In many communities no weight records are maintained. A common procedure for determining generation rates is to count the trucks and then, assuming they are fully loaded, estimate the tonnage based on the total volume of the trucks entering the site. Such a procedure can be very misleading and should be avoided.

Communities lacking scales at their disposal sites have several alternatives that can be utilized instead of volume measurements. The best approach, short of installing a platform scale, is to reroute the collection vehicles to an existing scale on a temporary basis. A highway weigh station or a privately operated scale, such as at a trucking firm, may be available. The weighing schedule should be set up to allow for enough data to span seasonal and daily variations in generation rates. If only part of a community's waste will go to the recovery facility, demographic differences should also be accounted for in the weighing schedule.

In lieu of such a weighing program individual axle weights can be measured using portable scales at the disposal site. However, care must be taken to make an adequate number of weighings, even though axle weighing is more cumbersome and time consuming than whole-truck weighings.

A final, but least reliable method, is to use national average per capita generation data applied to the population to be served by the facility. This approach leaves considerable chance for error because local waste generation often is significantly different from national averages. In addition, quoted per capita generation rates may include different waste sources than those which will go to the recovery facility. (Commercial waste and construction debris are two examples where confusion could arise.) Thus, national average data should be avoided as a primary esti-

mate. However, properly interpreted national average data can serve as a check against measured weights. If differences are excessive, additional samples may be advisable.

- 8.1.3 Waste Composition. Evaluation, selection, and design of any resource recovery system requires accurate data about waste composition; i.e., what materials are present in the waste and in what proportions do they occur. This is particularly true where materials recovery subsystems are involved, as the composition of many valuable components (such as ferrous metal or aluminum) can vary significantly among different communities. Waste composition variations such as heat content, moisture content, and ash content can affect selection and design of energy recovery components.

Table 8-1 presents national average data on waste generation and composition. The limitations on using these data as a substitute for estimating local waste quantity also apply to determining composition.

TABLE 8-1
MATERIAL FLOW ESTIMATES OF RESIDENTIAL AND COMMERCIAL POST-CONSUMER SOLID WASTE
1973

Material	Pounds Per Capita Per Day	Percent
Paper	1.36	38.9
Glass	0.36	10.3
Metals	0.35	9.9
Plastics	0.14	4.1
Rubber and leather	0.10	2.7
Textiles	0.06	1.6
Wood	0.13	3.6
Total nonfood product waste	2.50	71.1
Food waste	0.47	13.3
Total product waste	2.97	84.4
Yard waste	.50	14.1
Misc. inorganics	.05	1.5
Total	3.52	100.00

There is disagreement on how much, if any, waste sampling for composition should be done. The major drawback is cost. A waste composition study could cost a community \$5,000 to \$20,000. This is a small price compared with the millions of dollars of capital investment involved. Some argue that the combustible fraction of the waste stream does not change significantly from place to place and, thus, that a facility designed to recover primarily energy (and perhaps ferrous metals) can be designed without such a composition analysis. (This would be particularly true where water-wall incineration is involved.) Although there is merit to this argument, moisture, heating value, and ash content are important data for design of energy recovery systems and should be estimated.

If recovery of aluminum or glass is being considered, a composition analysis is far more critical, as these materials vary significantly in percentage composition from place to place, and quantity in the waste stream would bear heavily on economic feasibility of recovery.

Clearly, the safest route is to conduct a waste composition analysis.

- 8.1.4 System Reliability. A solid waste management system must accept all waste generated, when it is generated. Therefore, the system, including the resource recovery plant and the sanitary landfill, must be designed to operate reliably.

Reliability is defined here as the ability of the plant to accept and process the community waste on a regular basis. Reliability is achieved by a combination of the following:

- (a) Operational reliability of the equipment
- (b) Redundancy of equipment or subsystems
- (c) Storage capacity, combined with excess processing capacity to handle backlogs and current demands at the same time.

The local government must specify the degree of reliability it requires of the plant. Because reliability is achieved only with an increase in cost, the degree of reliability desired will have to be evaluated in terms of the capital and operating costs of the system.

- 8.1.5 Plant Location. Solid waste processing plants should be located near centers of solid waste generation in order to minimize haul costs and be readily accessible by major transportation routes where traffic will present minimal environmental impacts. The location should also be compatible with market requirements. For example, waterwall boilers should be located as close as practical to steam users to avoid large steam transmission losses. When

solid fuels or recovered metals, paper, and glass are being sold to distant markets, access to rail sidings and major thoroughfares should be available. The site should be industrially zoned. Public utilities such as power, gas, water, and sewage should be available at reasonable installation costs. Truck traffic through residential areas should be minimized.

- 8.1.6 Land Required for the Plant Site. Land required for the plant site varies with the type and size of the system, and certain site-specific constraints such as highway access, height limitations, and typography. The following data are rough estimates indicating the order of magnitude.

Small processing plants (200 to 500 tpd₅* range) generally require three to five acres of land. Larger plants (more than 1,000 tpd₅) require at least 5 to 10 acres. Squeezing a plant into too small a site can be costly, and severely limit operating and maintaining the plant.

- 8.1.7 Community Acceptance. Attempting to acquire a site for a resource recovery system inevitably provokes opposition from the community. Some reasons for opposition are real and valid; other reasons are imagined and therefore invalid. The sponsor should recognize the difference and deal with them accordingly.

- 8.1.7.1 Valid Objections. Delivery, handling, and processing of waste creates many objectionable conditions, including noise, pollution, odor, danger, and unsightliness from truck traffic; and an unacceptable plant profile, such as a tall stack.

These objections should and can be met constructively by designing the facility to minimize or avoid these problems. Trucks can be routed away from residential areas. Driveways can be screened from view. Trucks can be painted attractively and cleaned frequently. Buildings can be designed with attractive landscaping and facades. Odors, noise, and debris can be contained within buildings. Some objections such as a tall stack, may be impossible to overcome.

- 8.1.7.2 Invalid Objections. Frequently, opposition is raised where there is no basis in truth. "Rats as big as dogs" and "belching black smoke" may have been evident in poorly

*tpd₅ - tons per day; 5 day week

designed and managed facilities in the past, but such exaggerations are no longer valid. Community leaders should make an attempt to educate their constituents to recognize the difference between real and imagined problems, so that the real problems can be managed in a rational and constructive manner.

- 8.1.8 Plant Costs and Revenues. Cost is usually the major factor in deciding to implement large-scale mixed-waste resource recovery plants. Unfortunately, little economic data are available. In the absence of operating data, cost projections must be based upon preliminary estimates by consulting engineers and system development companies; these estimates are derived from experience with pilot-scale operations and from equipment supplier quotations.

A major problem in projecting costs has been the general lack of comparability among cost estimates. There are two apparent causes for this. First, different cost-accounting methods are employed by various designers, making it difficult to compare cost projections in proposals from companies bidding on the same contract.

Secondly, most estimates have been site-specific and reflect a wide range of factors which vary from site to site. Capital costs on a 1,000 ton-per-day plant may range from \$15 to \$35 million, depending on the type of system chosen, site preparation and construction costs, including labor, materials, and equipment.

Annual costs, which include amortized capital cost and operating and maintenance costs, may vary from \$11 per input ton to \$24 per input ton, depending on, among other things, the utilization of capacity, the interest rate on borrowed funds, wage rates, utility rates, fuel prices, local taxes, and residual waste disposal costs.

Selling prices for the recovered products are also a great source of uncertainty. They exhibit large variations among geographic regions and have been subject to extreme fluctuations over time. Future negotiable prices for recovered fuels and materials are subject to additional uncertainties due to technical questions about product quality.

As several plants now begin regular full-scale operation, reliable data will become available.

- 8.2 Energy Recovery Systems. The potential for recovering energy from municipal solid waste has increased sharply in recent years because of the decreasing availability and rising cost of conventional fuels. Approximately 70 to 80 percent of urban waste is combustible; with reported heating values of 3500 Btu/lb to 6500 Btu/lb; average about 4600 Btu/lb. As

a result, solid waste is now being regarded as an energy source.

The objective of energy recovery systems is to utilize the heat of combustion (the energy) contained in the waste. Coincidentally, the volume of refuse to be disposed in sanitary landfills would be significantly reduced, resulting in saving scarce landfill space. Cost reductions would also be realized due to shorter haul distances to centrally located resource recovery plants and the sale of valuables recovered from the refuse.

This section considers the direct generation of steam in water wall furnaces, preparation of solid, gaseous, and liquid fuels, and production of synthetic chemicals.

Technology descriptions include status of development, material and energy balances, special considerations, and related product characteristics.

Table 8-2 is a list of the various technologies that can be used to recover energy from municipal solid waste. For each system, the various types of energy products that can be extracted are identified, and locations of operating or planned full-scale plants are indicated.

8.2.1 Waterwall Furnaces. Waterwall furnace technology has been demonstrated over a period of 50 years in units using low grade coal and other waste fuels. One pound of solid waste can produce between one and three pounds of steam, depending on design conditions. The steam can be used to satisfy in-house energy requirements and the excess sold to a customer, or it can be used to generate electricity.

8.2.1.1 Process Description. Refuse is delivered to the facility and deposited on a tipping floor or in the storage pits from which it is transferred to the furnace feed hopper (Figure 8-2). From the feed hopper, wastes are continuously drawn into the furnace where they are burned and heat is recovered.

Waterwall furnaces are enclosed by closely spaced water filled tubes. Water circulates through the tubes to recover heat radiated from the burning fuel bed. Integrally constructed waste heat recovery boilers generate steam while reducing the temperature of the exhaust gases. Heat is transferred by convection from hot gases passing over boiler tubes in the convection section of the boiler. Thus, a marketable product is created while reducing the stack gas volume which permits use of smaller gas cleaning equipment.

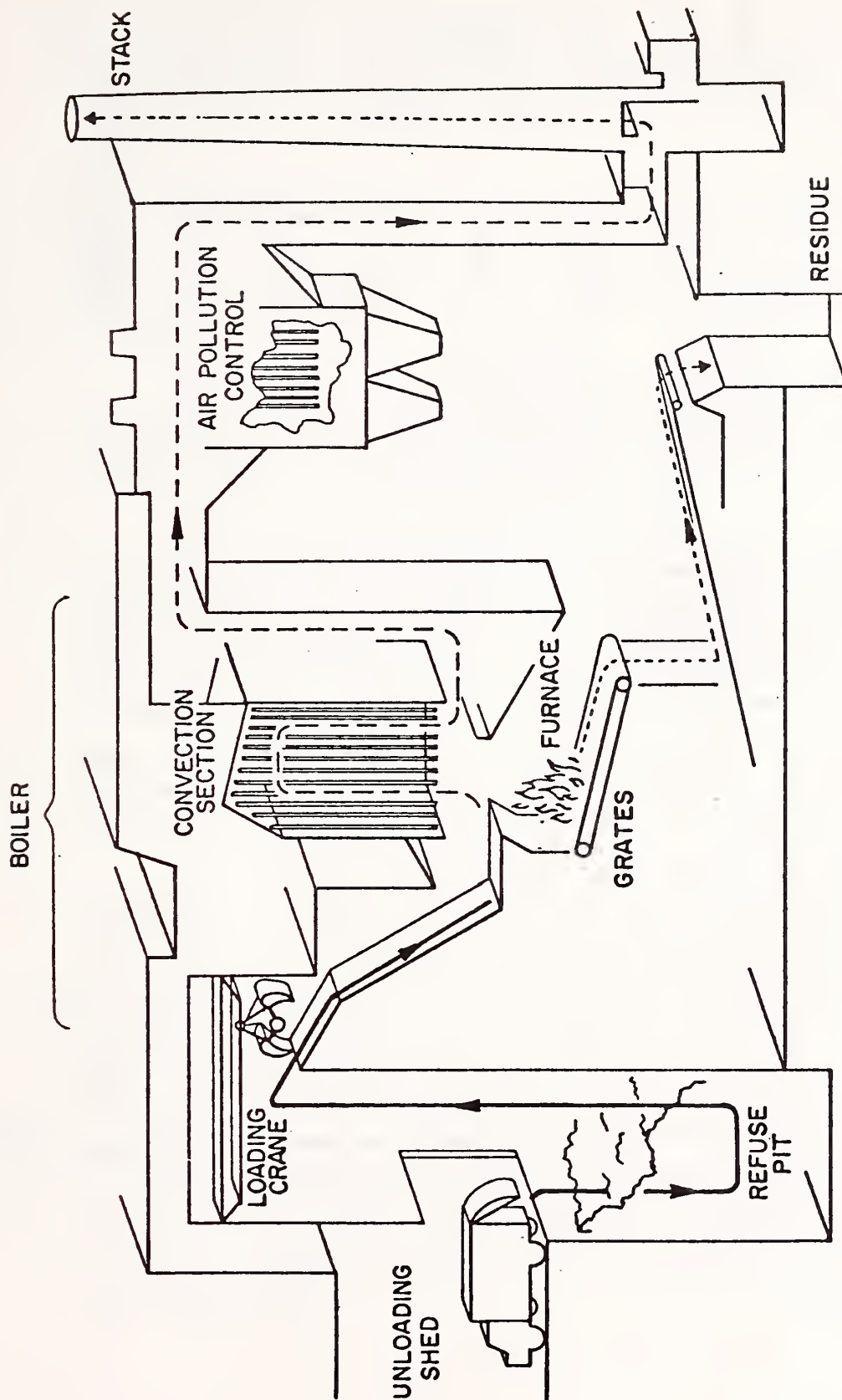


Figure 8-2
Typical Waterwall Furnace for Unprocessed Solid Waste

TABLE 8-2
ENERGY RECOVERY TECHNOLOGY AND PRODUCTS

PRODUCT TECHNOLOGY	ELECTRICITY	STEAM	SOLID FUEL	GASEOUS FUEL	LIQUID FUEL
WATERWALL FURNACE	Frankfurt, Germany (O)* Hamburg, Germany (O) Zurich, Switzerland (O)	Baintree, Mass (O) Harrisburg, Pa (O) Norfolk, Va (O) Chicago, Ill (O) Nashville, Tenn (O) Portsmouth, Va (C) Hamilton, Ont. Can (O) Saugus, Mass (C) Montreal, Can. (O) Quebec, Can (O) Plus several hundred more units operating in Europe and Japan	N/A	N/A	N/A
SOLID FUEL (RDF) DRY PROCESS	St. Louis, Mo (D) St. Louis, Mo (O) Chicago, Ill (C) Ames, Iowa (S) Milwaukee, Wis (D)	Columbus, Oh (D)	Los Gatos, Cal (D) Bridgeport, Mass (D) Brocton, Mass (D)	N/A	N/A
WET PROCESS	Hempstead, NY (D)	Japan (S)	Franklin, Oh (O)	N/A	N/A
GASIFICATION THERMAL					
LOW BTU	Possible	Luxembourg (C) Baltimore, Md (S)	By-Product	Possible	N/A
MED. BTU	Possible	Possible	By-Product	S. Charleston, W. VA (P)	N/A
BIOLOGICAL LANDFILL	Los Angeles, Cal	Possible	N/A	Los Angeles, Cal (O) Phoenix, Ariz (S)	N/A
REACTOR	Possible	Possible	By-Product	Franklin, Oh (P) Pompano Beach, Fla (P-D)	N/A
LIQUIFICATION	Possible	Possible	By-Product	Lansing, Mich (P,D)	San Diego County, CAL (D)
ADVANCED SYSTEMS					
BRAYTON CYCLE	Menlo Park, Cal (P)	By-Product	N/A	N/A	N/A
BIOSYNTHESIS	Possible	Possible	N/A	Possible	Possible

*Operating status is designated as:

P—Pilot
D—Design
C—Construction
O—Operational
S—Start-up

In the combustion process, oxygen (air) is required to burn the fuel and release heat. Air is introduced into the furnace beneath the grates (underfire air) to help keep the grates cool and above the fuel bed (overfire air) to promote mixing of the gases (turbulence) and to complete combustion in the furnace.

Combustion is improved by agitating the fuel bed using stepped or reverse reciprocating grates. Agitation results in rapid ignition, effective mixing, and leveling of the fuel bed serving to increase the completion of combustion and minimizing the amount of residue to be disposed.

Bottom ash falling off the end of the grate is generally quenched in a water trough and taken to an ash storage area prior to disposal. Bottom ash and siftings can be disposed of in a sanitary landfill, or recycled into some form of building material.

Flue gases leaving the boiler may also be passed through an economizer where some waste heat is used to heat the boiler feed water. Economizers improve the thermal efficiency of the unit. The cooled combustion gases pass through air pollution control devices and, after cleaning, are vented to the atmosphere through a stack.

- 8.2.1.2 Status of Technology. The use of waterwall furnaces for the recovery of steam from the combustion of refuse has been practiced widely in Europe for over 20 years.

Application of waterwall incinerators in the United States for the recovery of waste heat has been encouraged by the success of European experience. The first large-scale United States refuse burning furnace utilizing waterwalls and recovering steam is at the U.S. Naval Station, Norfolk, Virginia. This 360 ton per day plant has operated successfully since 1967. The steam produced is used to satisfy the station's requirements for heating and cooling. Other facilities have been successfully operated for several years; but, for nontechnical reasons, steam has been sold only intermittently. Those facilities are located in Chicago, Illinois; Braintree, Massachusetts; and Harrisburg, Pennsylvania. A new steam generating incinerator located in Saugus, Massachusetts, will sell superheated steam to an industrial user. The market was obtained before the plant was built.

8.2.1.3 Product Characteristics. Steam produced in incinerator facilities may be used in-house or for district heating and cooling, electricity generation, and to drive machinery in industrial processes. Steam customers are usually utilities or large industrial complexes. Steam temperatures range from 250° F to 1050° F, and pressures range from 150 pounds per square inch gauge (psig) to 850 psig. As a rule, higher temperatures result in a more marketable steam product, but they also result in larger maintenance expenses. In steam distribution systems, steam temperatures are kept low to minimize heat losses. In electric power plants, however, high temperatures and pressures are desirable because they increase generating efficiency.

While steam is an almost universally usable source of energy, it is limited to local use. In addition, the marketing of steam requires a suitable distribution system. Arrangements for the sale of steam must be made in order to generate revenues to offset the costs of waterwall furnace incineration. Also, the steam can be sold only to customers physically connected to the plant, thus creating a situation where the customer could set unrealistically low purchase prices. Without a steam customer, the steam must be condensed, thus increasing operating costs while losing revenue.

8.2.2 Dry Processing of Solid Waste. Mixed solid waste can be shredded and separated into a light, combustible fraction and a heavy fraction which contains most of the metals, glass, and heavy organics. Utility or industrial users provide a potential fuel market for the light fraction, which is primarily organic. It must be remembered that, whereas a waterwall furnace is a self-contained steam generator, a dry processing RDF plant prepares fuel for use in a separate combustor and heat recovery system.

Rough shredding yields coarse RDF which can be air classified and screened to yield fluff RDF. Embrittled, milled, and dried fluff RDF is called dust RDF.

When considering the implementation of such a system, it should be remembered that the fuel preparation process is usually the responsibility of the municipality and/or the private sector while the fuel burning facility is the responsibility of a large industrial user or electric utility. In the case of an existing fuel burning facility, the major capital expense of the boiler has already been

borne by the fuel user. Hence, although most of the new capital investment will be the responsibility of the organization preparing the fuel, the total new capital cost of an RDF system will probably be lower than any competing alternative.

The use of dry shredded refuse as a supplemental fuel in utility and industrial boilers is attractive for a number of reasons:

- (1) The sulfur content of municipal refuse ranges between 0.1 to 0.3 percent (an order of magnitude less than that of coal, and about half that of oil), thus its use as a fuel could reduce sulfur emissions.
- (2) The average heating value of refuse is, at 10 million Btu/ton (MBtu/ton), lower than that of either coal (22 to 28 MBtu/ton) or light oil (154,600 Btu/gal).
- (3) The volume of flue gas generated per million Btu (the parameter the boiler is concerned with) is for all practical purposes the same.

Since the costs of coal and oil (at the time of this writing) range from \$40 to \$60/ton and \$0.26 to \$0.40 per gallon, respectively, there is a good potential market for shredded fuel.

8.2.2.1 Process Description. Refuse-derived fuel may be classified as coarse, fluff, or dust, depending on the degree of processing. Coarse RDF can be used in boilers equipped with grates, fluff RDF can be used in suspension-fired boilers, and dust RDF can be burned alone or emulsified with oil to form a slurry for use in conventional boilers. Each of the fuels can be substituted for ones which have received less processing.

Figure 8-3 is a flow chart showing typical steps in the preparation of various types of RDF.

Coarse RDF is prepared by shredding raw refuse to a nominal size of between 4 and 8 inches (10 and 20 cm), resulting in partial homogenization of the waste. Coarse RDF contains large quantities of grit. All the undesirable components of the refuse (glass, grit, metal, chlorinated plastics) which present corrosion, erosion, and material handling problems are contained within the fuel. Coarse RDF bridges easily (hangs up on hoppers and will not flow) in

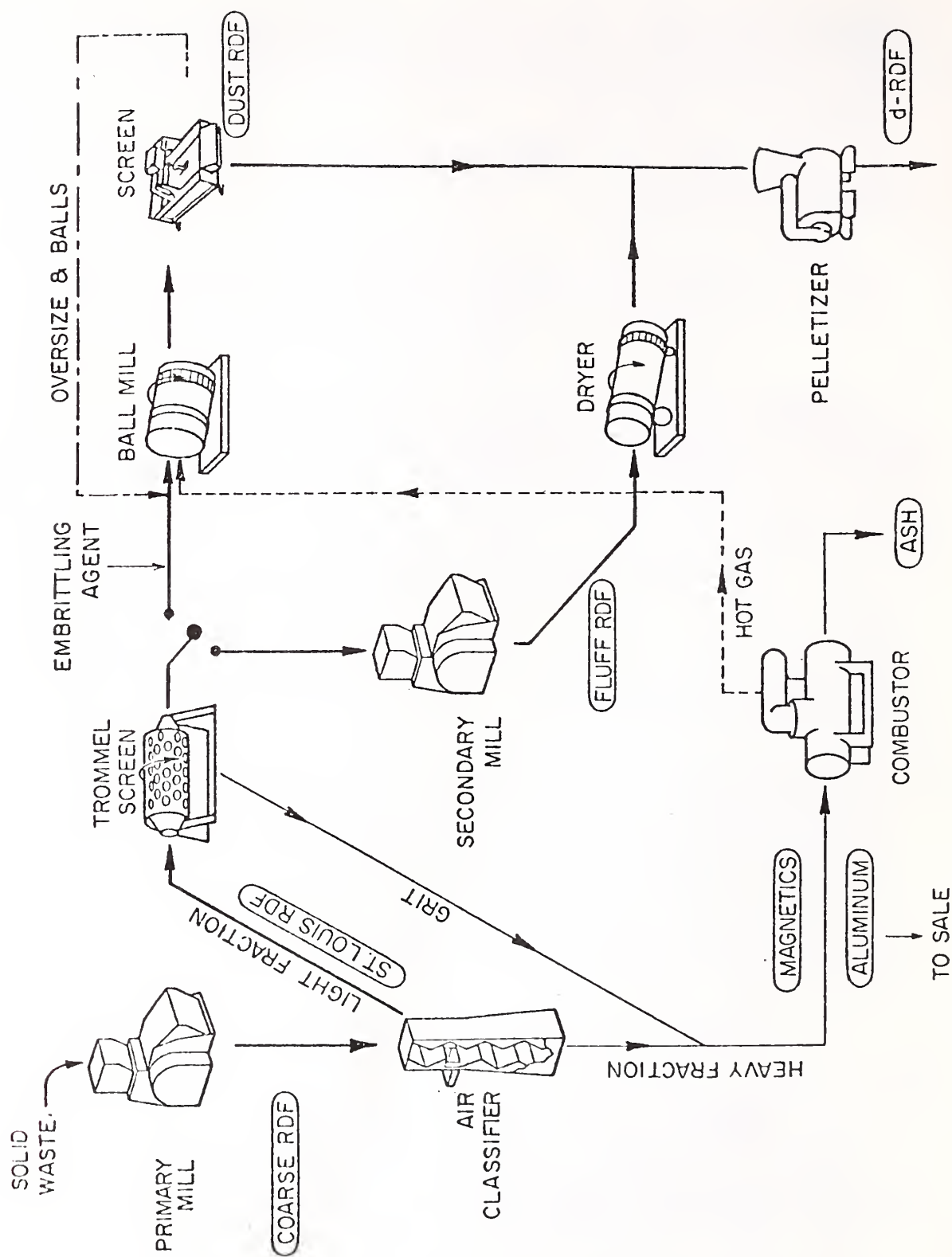


Figure 8-3
General RDF Production Schematic

storage. To avoid this problem, it must be stored in live bottom hoppers with sides that flair outward toward the bottom. In addition, if coarse RDF is stacked more than 10 feet (3 meters) high in a hopper when it is not being continuously withdrawn from the bottom, the material tends to solidify. This has caused significant difficulties upon bin restart. Because the refuse is moist and, in a still bin, compact; spontaneous combustion has been experienced. Coarse RDF has the same thermal properties as raw solid waste; i.e., 4600 Btu/lb, 26 percent moisture and 29 percent ash. Its bulk density, however, is only 2 to 9 lb/CF, depending on time in storage.

Fluff RDF is prepared by air classifying and screening coarse RDF to remove most of the grit and large inerts such as rocks, and metal debris. Air classification vacuums off light material.

Unfortunately, large wood fragments are also separated, losing a desirable fuel component. The nominal particle size, depending upon whether or not material is reshredded, averages between two inches (5 cm) and four inches (20 cm). Removal of screenable dirt, grit, and glass fragments to decrease the fuel ash content, further increases the heating value of the fuel while reducing the amount of material to be handled in the boiler's ash handling system. Fluff RDF has a nominal shelf life of about five days. Longer storage encourages spontaneous combustion. The material has the same bridging and flow characteristics as coarse RDF.

Dust RDF is the most advanced RDF form. Fluff RDF is blended with an embrittling agent* and processed in a heated ball mill until the product will pass a 100 mesh screen (less than 0.15 mm). The product is homogeneous and is believed to exhibit the least variability of any RDF. Dust RDF consists primarily of small paper fiber platelets. Consequently, it behaves like a powder, can be stored in silos, and can be handled with conventional flour and pulverized coal handling equipment to minimize the explosion potential due to its powder-like form. Dust RDF can be slurried with oil and burned in conventional oil-fired boilers. Dust RDF has a higher heating value of 6900 Btu/lb and contains 10 percent ash and 2 percent moisture. Its bulk density is approximately

*A chemical which hardens cellulose so that paper and cardboard will shatter upon impact.

25 to 32 lb/CF. It appears to have unlimited shelf life.

Finally, any of the three forms of RDF may be agglomerated or densified to form densified RDF (d-RDF). Coarse and fluff RDF agglomerate well in pelletizers, briquetters, and extruders, but agglomeration of dust RDF requires a lignin binder and processing in a briquetter. Densification increases the bulk density of RDF to 35 to 42 lb/CF (approximately that of coal). It can be handled like and blended with coal.

- 8.2.2.2 RDF Use. RDF-fired boilers must have both bottom ash and fly ash handling equipment. If a boiler is designed to utilize coal or is designed to be convertible to coal firing, then use of RDF in that boiler is probable; if the boiler was designed for high ash oil or crude oil firing, convertibility is possible; if, however, the boiler was originally designed to fire low ash oils or natural gas, then the probability of conversion is low.

For preliminary evaluations of existing facilities, assume that 20 percent substitution of RDF for high rank coal is the maximum permissible without boiler derating (reducing the amount of steam the boiler can produce). This substitution ratio was determined by comparing the required furnace volumes for suspension firing of coal and RDF. If a boiler is designed for the suspension firing of lignite or brown coal, then 100 percent substitution will probably be permissible.

- 8.2.2.3 Status of Technology. Extensive testing of co-firing RDF and coal in an existing pulverized coal boiler has been carried out by the Union Electric Company and the U.S. Environmental Protection Agency. The system installed in St. Louis, Missouri, utilizes a fuel product midway between coarse and fluff RDF (see Figure 8-4). Unscreened fluff RDF is transported from the shredding facility to the power plant where it is fired in an existing 140 MW tangential, suspension fired, pulverized coal boiler. Up to 18 percent of the heat input to the boiler has been supplied by the RDF during testing. Both the fuel processing and fuel firing systems performed well. To date, no significant boiler control or stability problems have been encountered. Higher substitution ratios have not been tried because the fuel handling system is physically limited to 18 percent substitution.

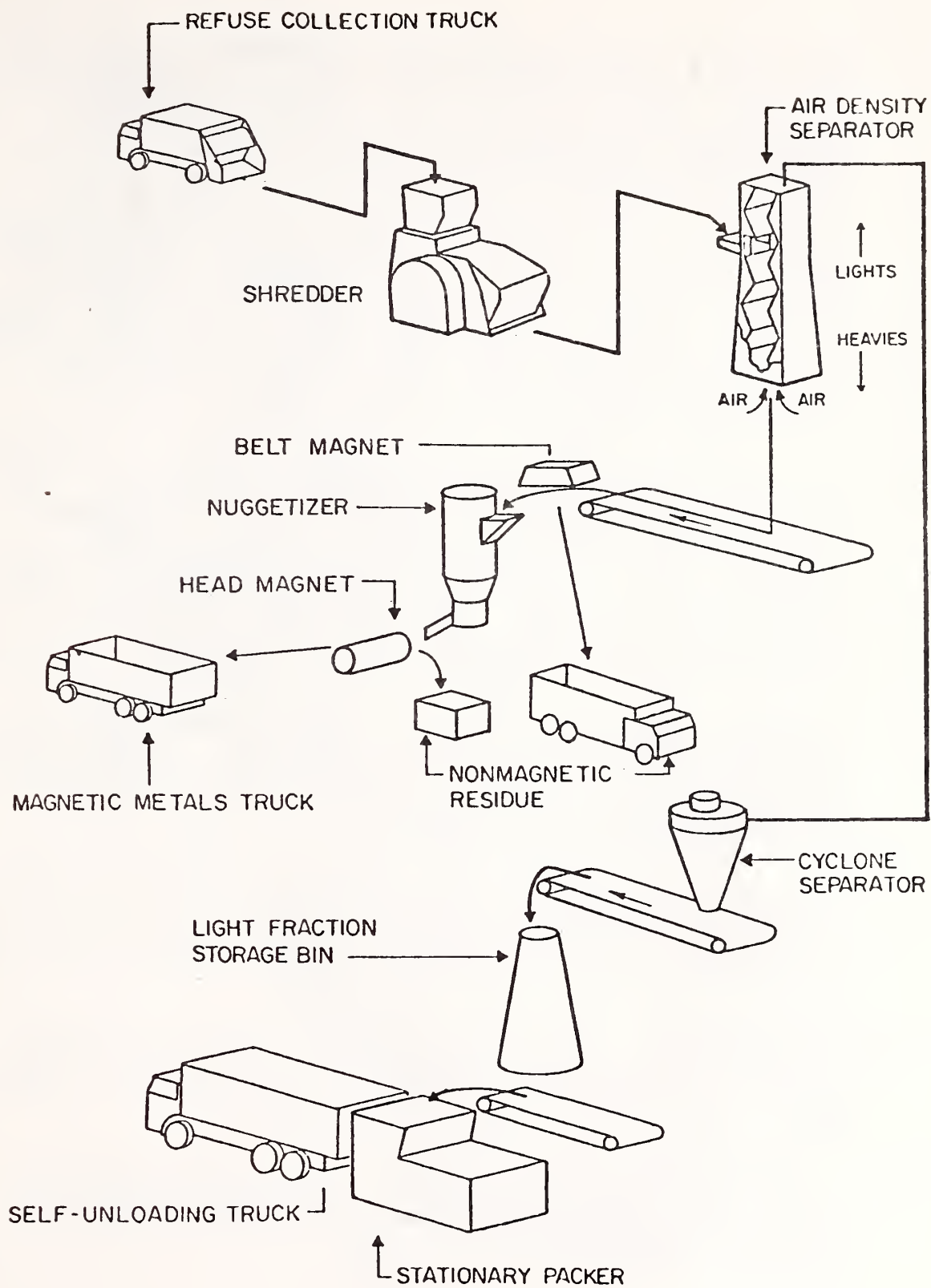


Figure 8-4 St. Louis RDF Preparation Facility

The St. Louis demonstration project showed that RDF can be safely substituted for 10 to 20 percent of the heat input of a coal-fired furnace without any apparent adverse impacts on the boiler or power production. The work has revealed, however, that the shredded refuse must be air classified. Air Classifier heavies will not burn to completion and accumulate in the furnace bottom. Also, the desirability of screening the refuse to remove grit and glass fragments, which cause boiler tube erosion, has become apparent. While air classification removes much of the material which tends to impact on the superheater tubes and cause erosion of the tube surfaces, additional wastage can be prevented by screening coarse, air classified, RDF, and firing fluff RDF.

Suspension-firing RDF in existing coal-fired boilers is being used by a growing number of communities. In Chicago, Illinois, and St. Louis, Missouri, expanded systems which utilize suspension firing of RDF in existing utility boilers are being constructed. The system in Ames, Iowa, is being operated and in Columbus, Ohio, the utility will use coarse RDF in spreader stoker equipped boilers to provide low pressure steam for district heating and cooling.

- 8.2.2.4 Product Characteristics. Dry shredded RDF preparation processes have yielded fuels with heating values ranging from 4500 to 8000 Btu/lb. The marketability of these fuels is dependent on many factors which relate RDF characteristics to user requirements.

It must be emphasized that the sale price of dry shredded solid is a function of the cost of the fossil fuels being replaced. Thus, if refuse derived fuel were to replace industrial fuels instead of utility fuels, it would probably bring a higher price.

- 8.2.3 Wet Processing. RDF can be prepared using a waterborne or wet processing system instead of an airborne or dry approach. Wet processing involves size reduction, materials removal, and drying or dewatering steps.

- 8.2.3.1 Process Description. Figure 8-5 is a flow chart of a typical wet processing system. This particular flow chart is based upon the scheme developed by the Black Clawson Corporation.

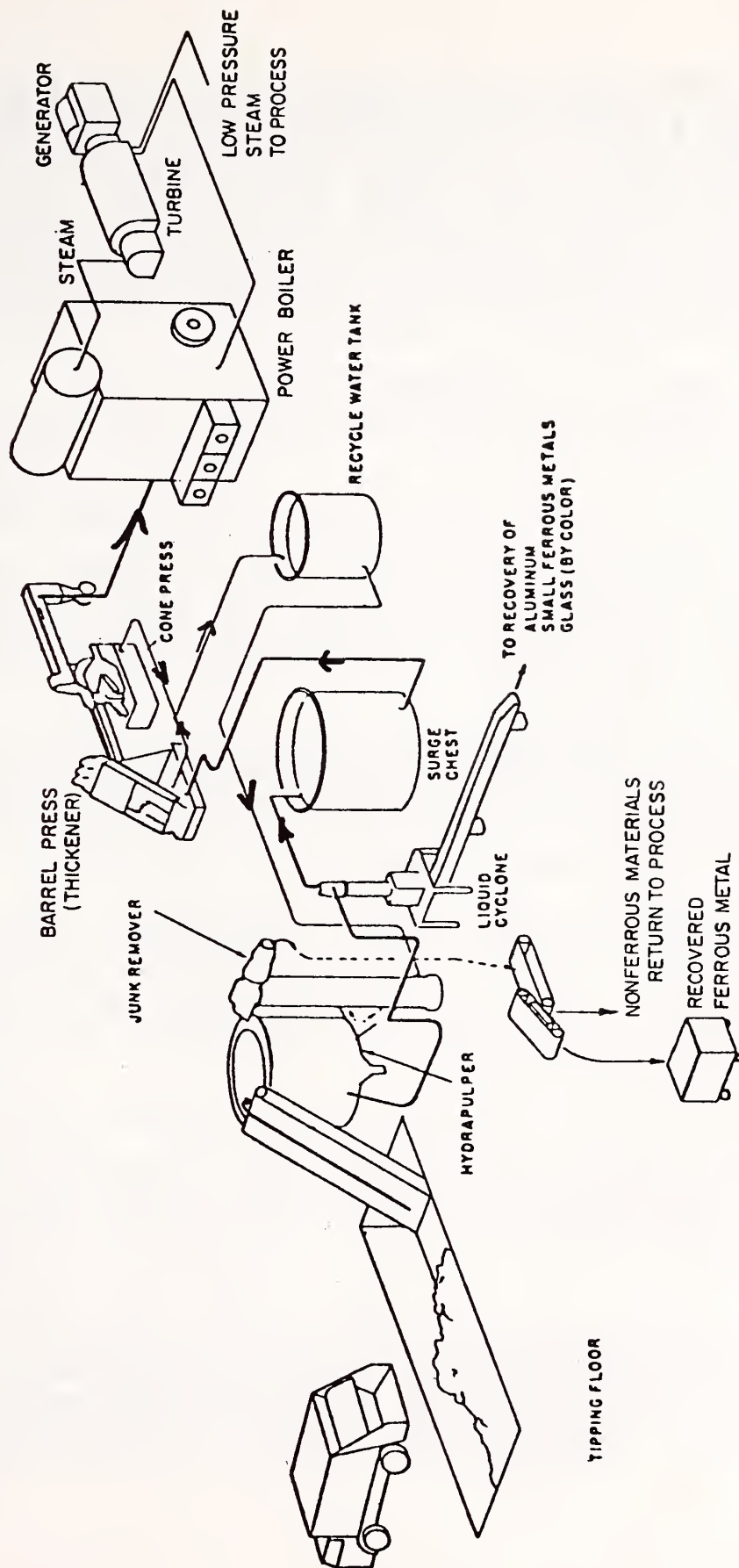


Figure 8-5 Wet Process Energy Recovery System

Solid waste is delivered to the facility and conveyed to a wet pulping machine (pulper) where it is mixed with recycled water. The waste material is reduced to an aqueous slurry by the action of a high speed cutter at the bottom of the pulper. Large items, such as tin cans, stones and other inorganics, are ejected through an opening in the side of the hydrapulper. These materials are washed and conveyed to a magnetic separator where magnetic materials are separated from the nonmagnetics.

The slurry containing pulped solid waste, including friable glass and ceramics, is pumped to a liquid cyclone where heavier materials are removed by centrifugal action.

The paper slurry is then dewatered in a series of mechanical presses to approximately 50 percent moisture content and pneumatically conveyed to a boiler. The boilers are especially designed to burn the 50 percent moisture residual; these boilers are similar to bark and bagasse burners which are used successfully in sugar mills to burn bagasse, a material with similar thermodynamic properties.

RDF is homogeneous and has an as-received heating value of 3500 Btu/lb, a moisture content of approximately 50 percent, and an ash content of approximately 20 percent. The high moisture content of the fuel product precludes the use of this product in many existing boilers.

Because the processing scheme is wet, sewage sludge can be easily accommodated in the process. By blending sewage sludge with the hydrapulped fiber, the resulting mixture can be simultaneously dewatered, and thus enable a community to solve both its solid waste and sewage sludge disposal problems.

- 8.2.3.2 Status of Technology. The basic processing steps are embodied in a 150 tpd demonstration plant located in Franklin, Ohio. The plant has been processing an average of 35 tpd of solid waste since 1971. Hence the fuel preparation components have a successful operating history.

To date, there have been several short duration test burns with the hydrapulped RDF in utility and industrial boilers. Fifty percent moisture wet process RDF was premixed with coal and fired at Bergstrom Paper Company through an overfed stoker. The fuel blend was difficult to handle outside the boiler, but burned well.

d-RDF made from wet process RDF was test fired at Piqua, Ohio, and Wright-Patterson Air Force Base. Each of these test burns was of short duration (up to five days) and involved low pressure (600 psi), low temperature (400°F) boilers. Each burn was successful. The burn at Bergstrom Paper showed some severe material handling problems in the peripheral equipment; unpelletized, dried material was handled in the existing feed shutes resulting in severe bridging. In tests of pelletized fuel and coal mixture, no flow or combustion problems were observed.

In October, 1975, Black Clawson started up a 150 tpd wet process solid fuel plant in Japan similar to that displayed in Figure 8-5. As a result, like the dry process fuel systems, wet processing as a route to steam production has been demonstrated.

- 8.2.3.3 Other Considerations. In addition to the air pollutants emitted during the combustion of any solid fuel, drying mechanically dewatered pulped solid waste (50 percent moisture) to the 20 percent moisture level needed for pelletizing poses a potential problem; the off-gases are odorous, especially if sewage sludge is blended with the fiber. One technique for eliminating this problem is to use the off-gases generated by the dryer as part of the combustion air for the dryer heat source. In this manner, the odor problem can be eliminated.

If wastewater treatment plant sludge is processed with the solid waste the odor within the RDF plant increases above that normally associated with solid waste processing plants.

The wet process solid fuel systems consume water during processing. By recycling the water within the plant, little or no water is discharged from the plant; thus, there is no need to treat large amounts of water.

- 8.2.4 Gaseous Fuels. Solid waste can be converted into a gaseous fuel for use in conventional boilers, furnaces and heaters. There are two major approaches to solid waste gasification, thermal and biological. Both of these technologies are founded on well proven principles.

Thermal processing is also called pyrolysis and was used to gasify coal in the late 1800s, using "town gas" reactors. These gasifiers were used to provide gas for lighting and heat in the major eastern cities prior to

the installation of the transcontinental gas pipelines. As a result, thermal gasification of organics, but not necessarily solid waste, has been a proven technology for more than 100 years.

Similarly, biological conversion of organic material to gas involves a well known concept; the anaerobic fermentation in a digester. This is the same technology used in the anaerobic stabilization of sewage sludge. This process has been used for years to destroy the paper fiber in raw sewage sludge, stabilize the waste sludge, and produce methane gas for use in the sewage treatment plant.

It is important to note that, while the technology involved is old, commercial application of the techniques to mixed municipal waste is just beginning.

- 8.2.4.1 Thermal Processing. Thermal processing involves destructive distillation of the organic fraction of solid waste. Thermal gasification differs from incineration in that it is endothermic (heat absorbing) rather than exothermic (heat releasing). Unlike combustion; where, in the presence of air, the products of pyrolysis are oxidized to produce mainly heat, water, and carbon dioxide; the products of pyrolysis are; gases (primarily hydrogen, methane, carbon monoxide, and carbon dioxide), liquids (water and an oil-like substance composed of organic chemicals such as acetic acid and methanol), and solids (a carbonaceous char). The relative proportions of these constituents change depending on the reaction time and temperature and pressure of the pyrolyser. To maximize gas production, temperatures are in the range of 1400°F to 3000°F; for oil, temperature is kept below 1400°F. Pressures range from 1 to 70 atmospheres.

In order to accomplish the gasification reaction, refuse is exposed to high temperatures. Ideally, the reaction is allowed to take place in the absence of diluting gases so that the product is the volatile matter of the solid waste. Heating solid waste removes the volatile matter and leaves a carbon residue called char. The heat needed to gasify the volatiles is usually provided by a high temperature gas stream produced by burning the char. If air is used to burn the char, the gas product will be diluted by the nitrogen in air (air is approximately 79 percent nitrogen and 21 percent oxygen). As a result, some processes have been developed which use oxygen, thus resulting in a higher heat content fuel

gas. Other systems burn the char and indirectly transfer the heat to the gasifier to minimize dilution of the product gas.

In some reactors, the residue reaches such high temperatures that the ash and other noncombustibles, such as cans and glass, melt to form a slag which can be removed from the reactor in a molten state and quenched to form a glassy aggregate.

Residues produced from pyrolysis are biologically inactive and may be safely disposed in sanitary landfills. Solid residues from the noncombustible portions of the refuse, such as glassy aggregate, may be used for construction and paving. If the char is not consumed in the process, it has a higher heating value of up to about 9000 Btu/lb and can be used as a low sulfur fuel substitute for coal. Its high ash content (50 percent), however, limits its marketability. Clearly, failure to consume all the char in the process represents a loss in gas production.

8.2.4.2 State of Development. The easiest way to describe the emerging variations in pyrolyzers is to review the state of development of the various proprietary systems currently vying for commercial application. It is important to note that all these systems have been operated on a small scale; problems of building units five to ten times as large are formidable. Caution should be exercised to verify that scale-up can be accomplished.

8.2.4.3 Medium Btu Gas - Union Carbide "Purox" System. The Purox system disposes of municipal refuse by converting it into a medium Btu fuel gas (approximately 300 Btu/CF) and a sterile, compact residue (glass frit). A 200 ton per day demonstration facility is now being tested in South Charleston, West Virginia.

The key element of the system is the Refuse Converter Furnace (see Figure 8-6). Solid waste is fed intermittently at the top of the converter and 95 percent pure oxygen is fed continuously into the bottom of the reactor. The oxygen combines with the char at the base of the reactor to create 3000°F temperatures. Hot gases rise up through the descending solid waste column and provide the heat to pyrolyze the waste; no external fuel supply is needed. Over all, 80 weight percent of the solid waste is converted into fuel gas. Twenty percent is reduced to an inert residue representing two to three percent of the volume of the input waste. The

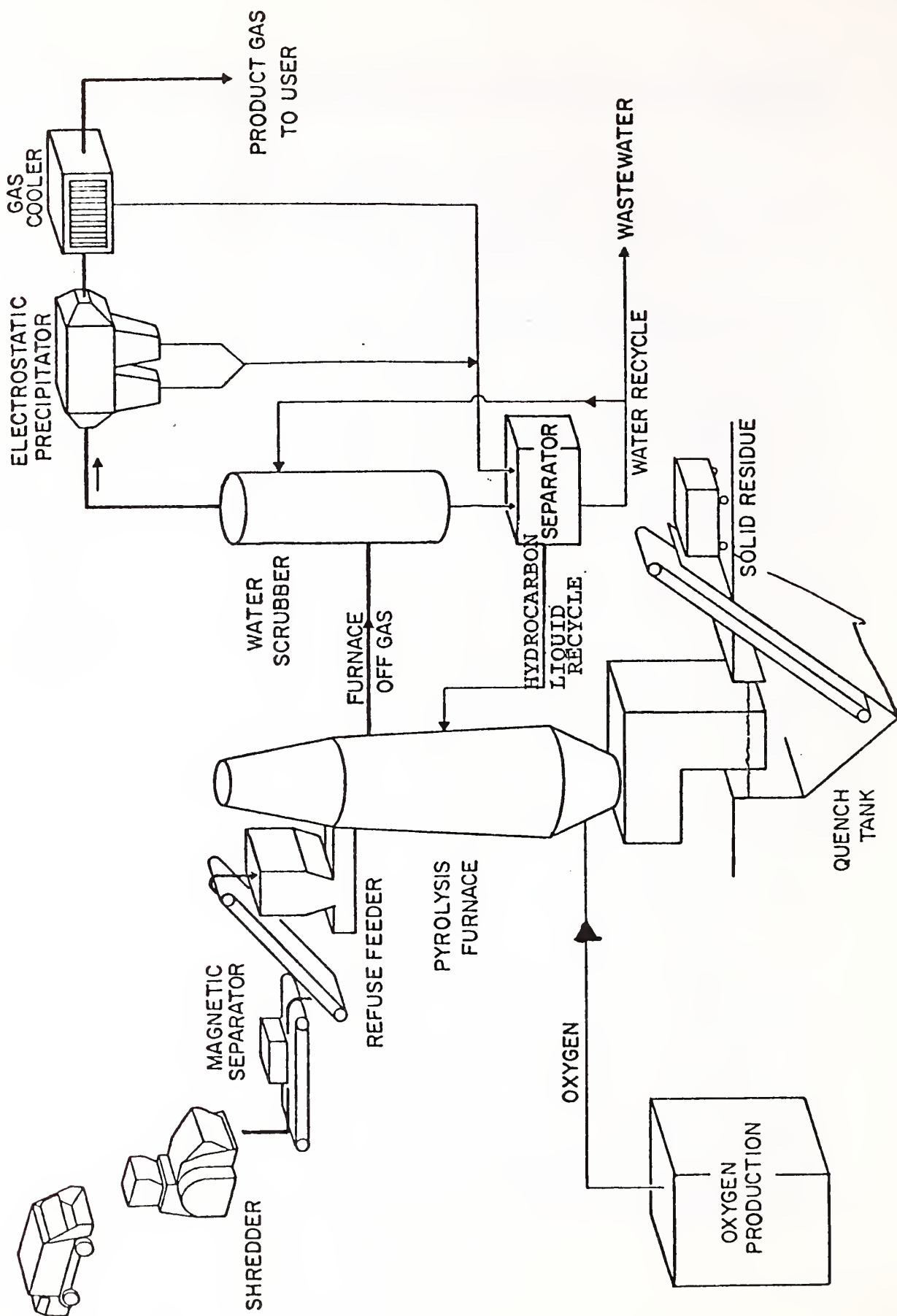


Figure 8-6. Union Carbide Purox System

fuel gas can probably be used in existing utility boilers (with modification). Burner nozzles must be enlarged to supply furnaces with large volumes of medium Btu gas in order to obtain the same heat input as the original design. A slight reduction in boiler output may result due to flame impingement problems on the walls of small oil-fired boilers. The gas may be fed to on-site gas turbines to generate electrical power. The Purox needs an economical supply of oxygen, usually an on-site oxygen production facility. Each ton of refuse processed uses about 0.2 ton of oxygen.

- 8.2.4.4 Low Btu Gas - Monsanto Landgard System. A 1000 tpd facility was constructed on a five acre industrial site in Baltimore, Maryland (see Figure 8-7), and is now being modified to comply with Maryland air pollution control regulations. The process involves a controlled air primary furnace chamber (pyrolyser) and immediate combustion of the low Btu products in an afterburner and recovery of heat. Waste is shredded, conveyed to a storage silo, and subsequently fed to a rotary kiln where it is pyrolyzed. Fuel oil is also burned in the kiln to provide some of the heat for the pyrolysis reaction. The burner is arranged to provide a counter-current flow of gases and solids, thus exposing the waste to progressively higher temperatures as it passes through the kiln. The finished residue is exposed to the highest temperature (1800°F) just before it is discharged from the kiln and quenched in a waterfilled tank. The residue is passed under a magnet and the ferrous materials recovered for sale. The remaining residuals are split into glassy aggregate and char fractions for use or disposal.

Gases resulting from this pyrolysis reaction have a high temperature and low heating value making off-site transportation uneconomical; therefore, they are immediately mixed with air and burned in an afterburner to liberate the heat of combustion. The gases then pass through waste heat boilers where steam is generated for distribution.

While the gases could be piped to a nearby boiler plant for combustion and heat recovery, the low heating value and high temperature of the gases makes piping them an energy-intensive approach to waste heat reclamation. As a result, on-site gas use and steam generation similar to a waterwall incinerator is probably the best use for the gas from the Landgard process. In fact, the difference between a waterwall incinerator and an Landgard pyrolyser is that the waterwall pyrolyses waste and burns it to completion in one chamber, while Landgard utilizes two chambers.

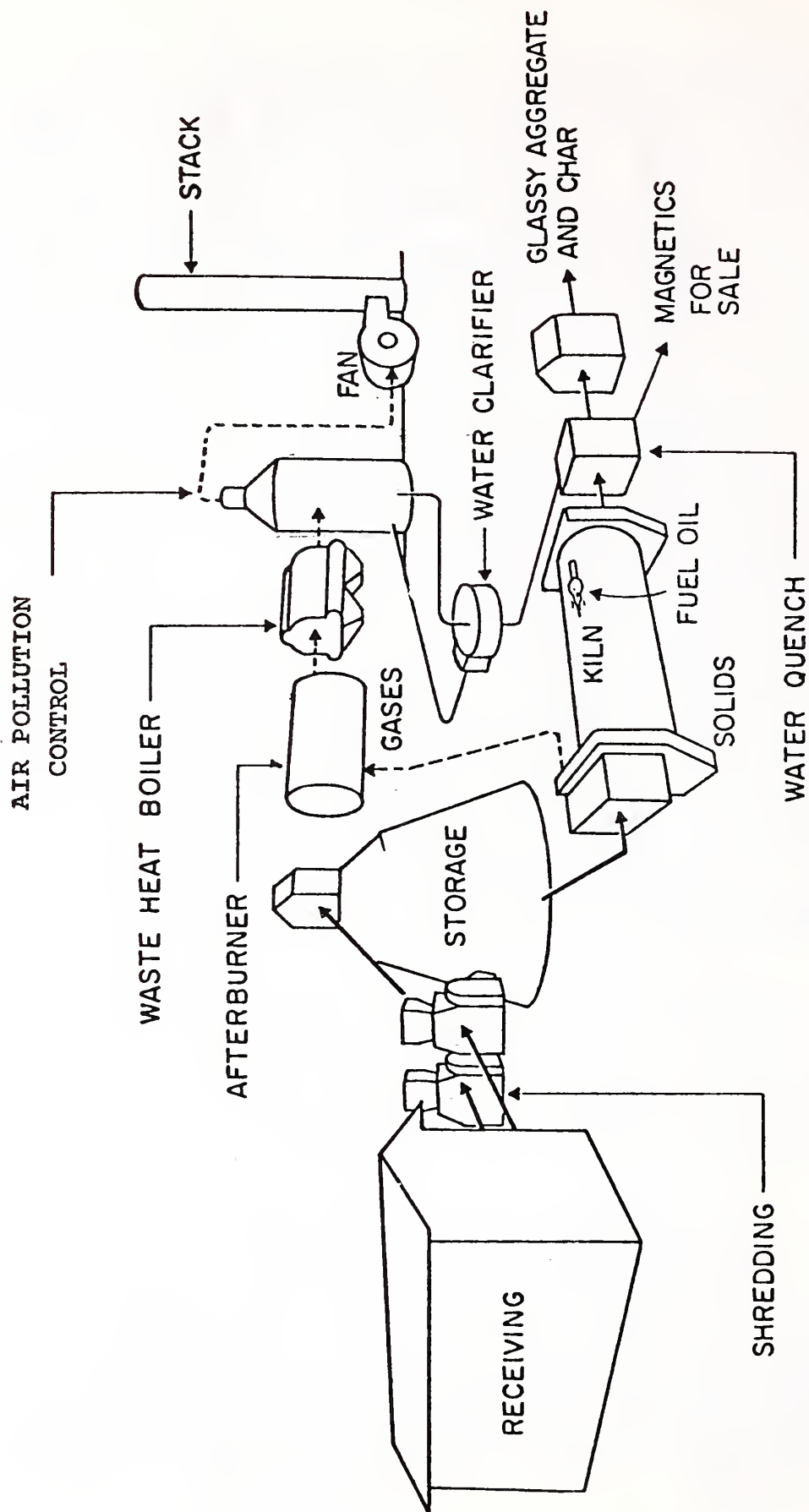


Figure 8-7. Monsanto Landgard

About 7.1 gallons of No. 2 fuel oil are consumed per ton of refuse processed.

- 8.2.4.5 Low Btu Gas - Torrax System. The Torrax system was demonstrated at a 75 tpd plant located in Orchard Park, New York (see Figure 8-8). The system is a high temperature pyrolysis process in which virtually all waste components are either gasified or melted to produce a molten slag. The slag is quenched in water to yield an inert glassy frit. Auxiliary fuel (3000 CF/ton natural gas) is used to preheat air which is then mixed with unshredded solid waste in a gasifier or reactor. Hot gases permeate the descending refuse, pyrolyzing the organic materials. Most combustibles never reach the high temperature zone (3000°F) at the bottom of the gasifier. An inert residue, representing about five percent of the volume and 20 percent by weight of the refuse charged, is produced.

Gases formed in the gasifier are admitted into an afterburner where they are mixed with ambient air and burned to yield 2000°F combustion products. Carried-over fly ash and similar noncombustible materials are centrifugally separated and fused on the walls; slag flows from the base of the afterburner into a water quench tank. Gases are then passed through a waste heat boiler to generate steam. Exhaust gases are cooled and cleaned in a pollution control train consisting of a scrubber and mist eliminator. The Torrax system does not require pretreatment for residential waste. However, bulky items must be shredded so that they can pass through the feed opening to the reactor. Like Landgard, the fuel gas can be burned in a nearby boiler instead of an afterburner. Due to the low heat content of the cooled, cleaned gas (65-100 Btu/SCF), on-site use to recover the sensible heat (10-20 Btu/SCF) is recommended. An anthracite-like carbonaceous fly ash (9200 Btu/lb) is also produced.

- 8.2.4.6 Product Characteristics. The energy products derived from gasification of municipal solid waste include steam and gases for on-site use. The steam produced by pyrolysis systems is identical to that from other sources; however, pyrolytic fuels are different from their fossil fuel counterparts. In some pyrolysis systems, the recovered fuels are of sufficient quality to permit virtually unrestricted use as auxiliary fuels in fossil fuel boilers. In other systems, the fuel quality is too low to justify their transportation to off-site facilities; and their contaminant levels will require extensive gas cleanup before they can be handled economically with conventional hardware.

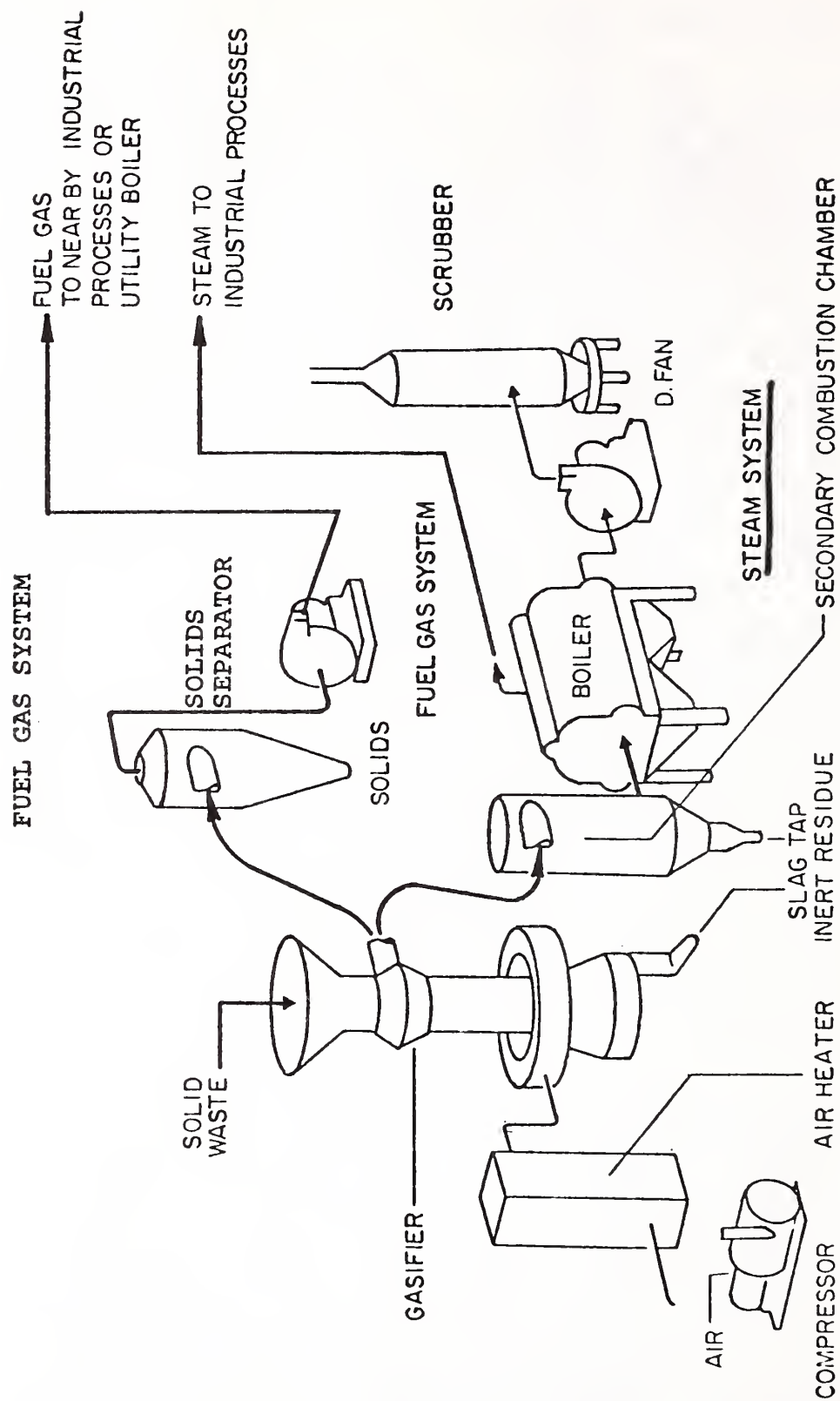


Figure 8-8. Torrax Slagging Pyrolysis System

Low Btu gas pyrolysis plants are best adapted to locations near large energy users in order to minimize pipeline and storage losses and costs. It should be noted, however, that pyrolytic gases may be upgraded to pipeline quality with increased capital and operating costs. Upgrading involves the removal of contaminants, adjusting the carbon monoxide to hydrogen level, and passing the gas through a shift converter similar to those being proposed for coal gasification plants to produce a methane-rich, high Btu gas (about 1000 Btu/CF).

Fuel gases produced by pyrolysis are clean burning fuels comparable to natural gas in combustion characteristics. They are practically free of sulfur compounds and have a heat value ranging between 120 Btu/CF (Monsanto and Torrax) and 300 Btu/CF (Union Carbide).

8.2.5 Biological Gasification. Anaerobic biological digestion of organic materials is a familiar and widely used process. Landfill stabilization, domestic sewage stabilization by septic tanks, or municipal sewage sludge digesters all utilize the same basic process. The level of knowledge and the engineering state of the art are such that the anaerobic digestion of solid waste may be an attractive energy recovery and waste disposal method in the near future. Recent research has expanded the knowledge about the use of anaerobic digestion to produce methane from solid waste.

8.2.5.1 Landfill Gasifier. In California, landfill gasifiers (Figure 8-9) are taking advantage of natural phenomena to convert refuse into usable methane. The system employs a deep (over 200 ft. depth) sanitary landfill with impermeable bottom and gas permeable (porous) daily covers for cells which have been allowed to attain field capacity by saturation with water and then capped.

Once wet, microorganisms begin reducing cellulose in mixed waste to methane and carbon dioxide. The landfill is equipped with vent pipes which direct the gas into a gas collection system. The gas is primarily methane and carbon dioxide, with small amounts of hydrogen sulfide and organic acids, and the gas stream is saturated with moisture. As a result, unless the gas is consumed in equipment specifically designed to utilize digester off-gas (as in sewage treatment plants), it must be dehydrated and "sweetened" (the carbon dioxide is stripped and the acids removed). This method of energy recovery results in a fuel product which can be obtained from an existing landfill and may be compatible with utility boilers and residential fuel requirements.

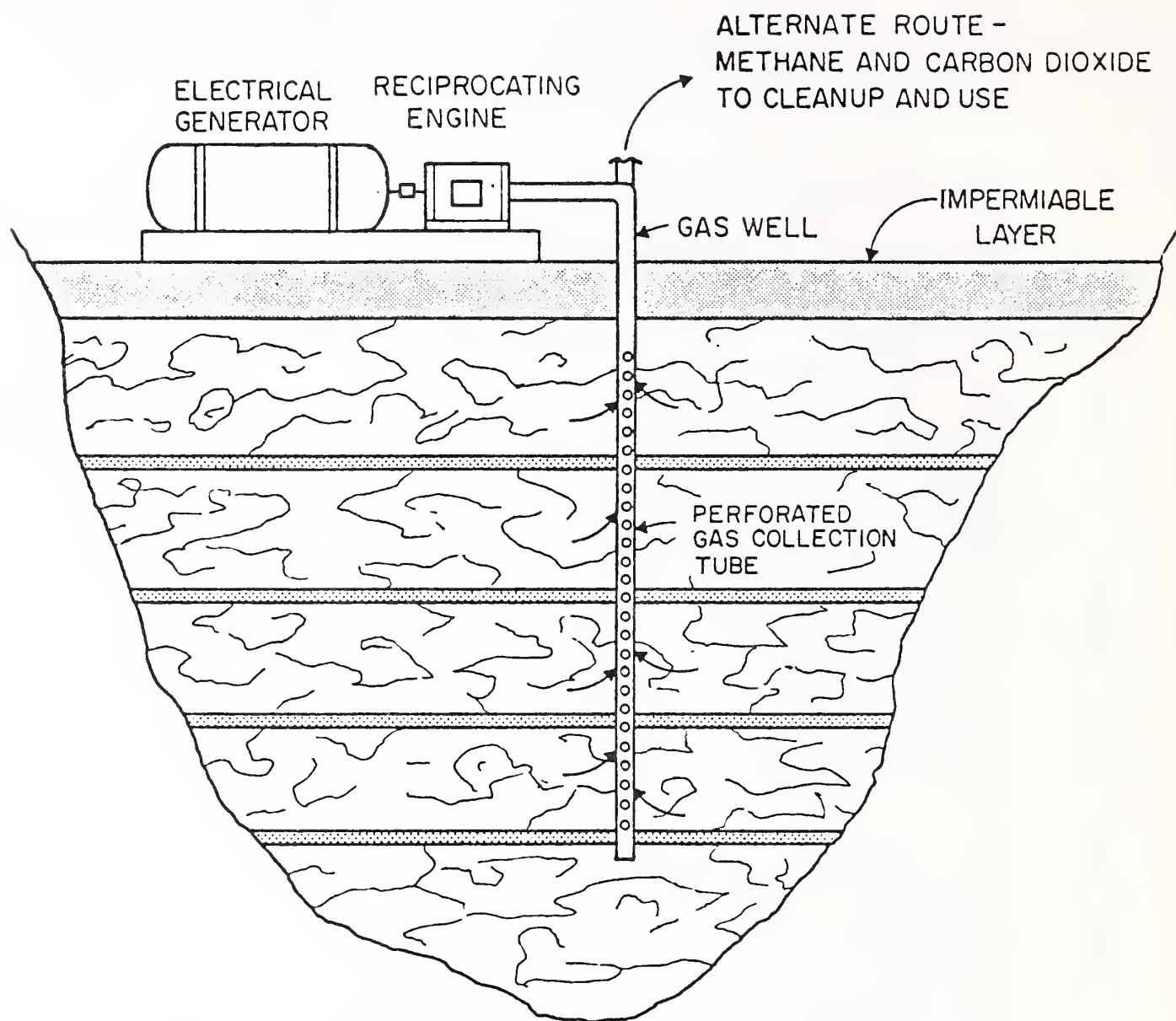


Figure 8-9. Production of Electricity from Landfill Gas

Pilot installations are currently recovering methane from landfills in Los Angeles, California, and Phoenix, Arizona (both direct use in a reciprocating engine - generator set, and sweetening to pipeline quality for residential consumption, are being practiced). The NRG Nufuel Company is presently examining other potential sites for gas extraction.

8.2.5.2 Reactor Gasifiers. Reaction-based gasification involves the controlled introduction of fluff or wet process RDF and sewage sludge into a heated, well mixed, anaerobic digester where the microorganisms reduce the cellulose in the refuse to methane and carbon dioxide (Figure 8-10). Like the landfill gasifiers, the off-gases from biogasification reactors must be dehydrated and sweetened before they can be placed into commercial distribution networks. Results from the pilot plant operated in Franklin, Ohio, indicate that the residue from the biological gasification reactor dewateres easily. It contains approximately half of the energy potential of the input waste. Using vacuum filters and mechanical presses, it can probably be dewatered to 55 percent moisture, the same as wet process fuel. The residue could then be used as a boiler fuel in specially designed boilers. This use must be carefully designed because the residue is odorous.

Reactor gasification is a potentially very applicable technology, but at the present time there are many unanswered questions. The results of laboratory and systems studies indicate that the technology is promising and economical when the price of gas rises above \$2.00 per million cubic feet. Since the intrastate price of natural gas is above that level in many states today, the entire process may prove to be economical in the near future. The market for gas will be home heating, so biogasification may be favored over competing technology (steam and solid fuels are aimed at utility and industrial markets) regardless of economics or energy efficiency.

SYSTECH is presently operating a one ton per day pilot gasifier in Franklin, Ohio, and Waste Management, Inc., is designing a 50 tpd prototype unit in Pompano Beach, Florida. The pilot plant operation utilizes feed stock from the Franklin, Ohio, wet process RDF plant. The reactor has exhibited severe mixing problems.

Questions remaining are:

- (1) Is the entire process economical?

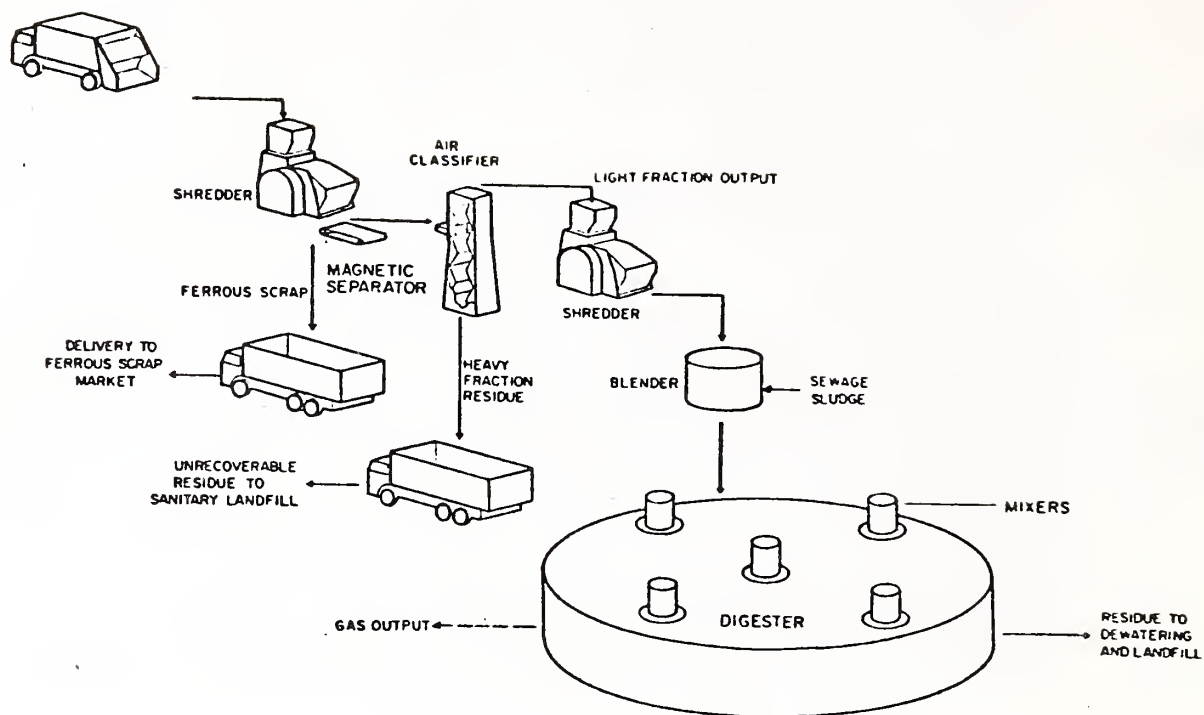


Figure 8-10. Biological Gasification of Refuse in Reactors

- (2) Can the reactors operate on mixed municipal solid waste (people throw out materials such as pesticides which have the capability of upsetting a digester and preventing it from producing gas)?
- (3) Is the existing equipment for mixing the refuse-sludge slurry in the reactors adequate or is a significant hardware development effort required?

8.2.6 Liquid Fuels. In addition to production of gas and solid fuels from mixed municipal waste, the organic fraction of the waste material can be thermally processed to produce an oil-like product. By reducing the amount of time refuse is held at high temperatures in an oxygen deficient thermal reactor, the cellulosic fraction of the waste can be converted into a pyrolytic "oil." The liquification principle can be incorporated in many configurations. Occidental Petroleum Corporation suspends the dry shredded waste in a low temperature (950°F) oxygen-free transport reactor with glowing coke for direct heat transfer and pyrolysis.

The Occidental process (Figure 8-11) utilizes double shredding, magnetic separation, air classification, screening, and drying to produce fluff RDF for the pyrolyser feedstock. Representing about 60 percent of the input stream, the fluff RDF is fed along with burning char to the "flash pyrolysis" reactor. Pilot plant work has shown that the Occidental system is flexible. Depending upon the operating temperature and refuse detention time, either a medium Btu gas (350 Btu/CF) or oil-like liquid with a heating value of about 65 percent that of No. 6 (heavy or residual) fuel oil can be produced (100,500 vs. 154,600 Btu/gal). Not all the solid waste introduced into the pyrolyser is converted into an "oil"; the residue is a carbonaceous char which is burned in a separate vessel to provide the heat of pyrolysis for the system.

- 8.2.6.1 Status of Development. San Diego County, California, has broken ground for a 200 tpd demonstration plant. Construction began in December, 1975, with financial support from the EPA. The oil will be used as a supplementary fuel in an existing boiler.
- 8.2.6.2 Product Characteristics. The pyrolytic oil produced from refuse degrades at temperatures of about 200°F. The viscosity will change, which introduces possible combustion control problems. Also, the oil will begin to vaporize and gasify, thus introducing potential vapor

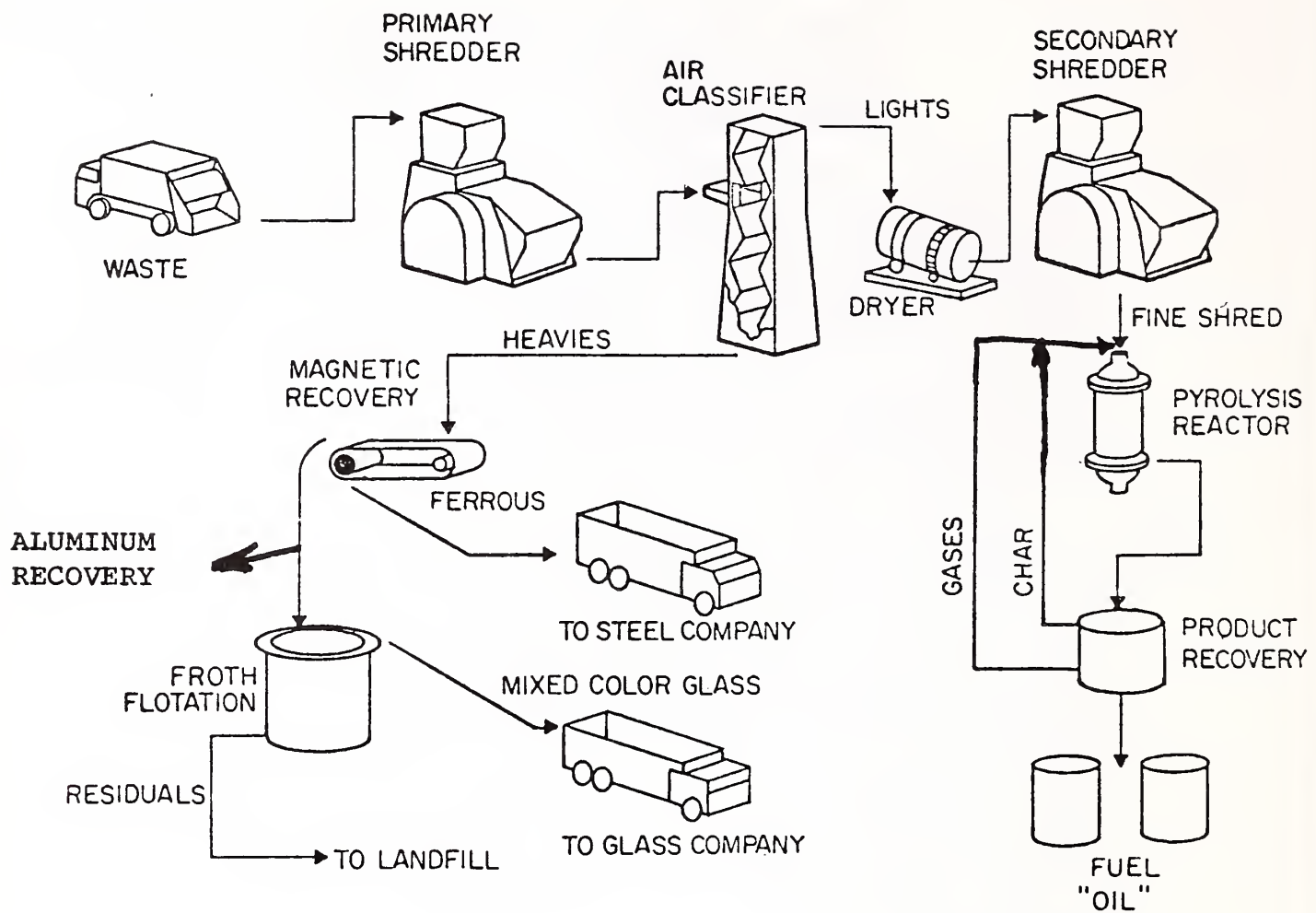


Figure 8-11 Production of "Oil" from Solid Waste Using the Occidental Process

locking, burner pulsation, and explosion hazard problems. Pyrolytic oil is corrosive to mild steel, but blending it with No. 6 fuel oil appears to solve this problem.

For every ton of solid waste processed, about one barrel (42 gal.) of fuel oil is produced. This oil has a higher viscosity than No. 6 oil, and hence must be pumped at higher temperatures (to reduce the viscosity) than those used for heavy fuel oils. Also, since the pyrolytic oil is water soluble, in-tank condensation is not as great a worry as with conventional fuel oils. While storing fossil oils, water is not dispersed, hence it can cause sputtering during combustion. Pyrolytic oils and water form homogeneous mixtures. Preliminary testing has shown that pyrolytic oils can be blended with No. 6 fuel oil and successfully burned in utility and ship boilers.

8.3 Materials Recovery Systems. Materials recovery encompasses methods and procedures for extracting useful materials from solid waste for return to the economy. The prime objectives in the development of materials recovery systems are:

- (a) To conserve natural resources and energy.
- (b) To reduce land requirements for disposal.
- (c) To facilitate the preparation of refuse derived fuels for energy recovery systems.

The purpose of a materials recovery system is the separation of the valuable marketable fractions in the solid waste. Traditionally this has been accomplished by scavenging or picking (a technique whereby an employee manually removes items from mixed waste). Scavenging is generally unsafe and uneconomical since labor costs are high. Mechanical separation methods capable of segregating solid waste into valuable components have been developed, based on techniques used in the mining and paper industries. These methods are aimed at minimizing the level of impurities in recovered products so that maximum dollar value can be obtained for the recovered material. Material recovery systems have concentrated on the reclamation of paper (the most abundant component in solid waste), magnetic metals (the most easily extractable), aluminum (the most highly valued), and glass (to date the hardest to extract).

Table 8-3 is a list of material recovery processes and some brief notes concerning installations and products.

TABLE 8-3.
MATERIALS RECOVERY SYSTEMS LOCATIONS AND PRODUCTS

System or Subsystem Type	Product Type					
	Paper Pulp	Soil Condition	Ferrous Scrap	Aluminum Can Stock and Foil	Mixed Glass Cullet	Color Sorted Glass Cullet
Fiber Recovery						
Wet Processing	Franklin, (Oh) *					
Dry Processing		Rome, Italy (O)				
Composting			Altoona, Pa (O)			
			others were not financially viable			
Magnetic Separation				St. Louis, Mo (P,D)		
				Columbus, Oh (O)		
				Charleston, SC (O)		
				Atlanta, Ga (O)		
Aluminum Recovery				San Diego Co. Ca. (C)		
Wet Processing				Franklin, Oh (S)		
Dry Processing				Ames, Iowa (S)		
				Milwaukee, Wis (D)		
				Monroe Co, NY (D)		
				New Orleans, La (D)		
Glass Recovery				San Diego Co. Ca. (C)		
						New Orleans, La. (D)
						San Diego Co., Ca. (C)
						Franklin, Oh. (S)

*operating status is designated as:

P-Pilot
D-Design
C-Construction
O-Operational
S-Start-up

There are two basic approaches to solid waste material separation; wet processing and dry processing. In the wet processing concept, separation technology presumes preliminary size reduction using a hydropulper. The light fraction from the hydropulper contains the majority of the magnetics. Each of these streams is processed to remove the marketable products. When the preprocessor is a dry system, air classified heavies can be placed in an aqueous slurry and processed using wet processing techniques.

In dry processing, separation technology begins with size reduction using a shredder. After shredding, the solid waste is air classified, where it is separated into light and heavy fractions. The light fraction contains the paper and the heavy fraction contains the magnetics, aluminum and glass. Each of the two streams produced by air classification can be further processed to recover the marketable materials.

Material recovery systems have emerged by combining materials and energy recovery subsystems. These systems are designed to serve as total solid waste disposal and/or energy recovery systems (fiber recovery, ferrous metal recovery, glass, and aluminum recovery). The following subsections describe some of the subsystems used in these solid waste disposal/energy recovery systems to recover valuable resources.

8.3.1 Paper Recovery. Paper recovery processes use either wet or dry primary separation of fibers from mixed municipal waste. The initial separation steps are similar to those employed in dry and wet RDF production facilities. Clearly, if a marginal paper market exists, a plant can be designed to produce paper stock when it is economical and fuel the rest of the time.

8.3.1.1 Wet Processing Concept - Fiber Recovery. The major components of a wet processing system have been described previously. The fiber recovery portion of the facility is described here.

Figure 8-12 is a flow chart of the components of the fiber recovery subsystem. The feedstock to the fiber recovery process is the same material as taken to the dewatering presses in a wet fuel processing system. The hydropulped solid waste is centrifugally separated and light fraction taken to fiber recovery. The first step in the beneficiation process is to remove all large particles from the slurry. This is accomplished by screening. All particles greater than 1/16 inch diameter, including the plastic films, are removed. The fibrous slurry is then passed through a series of high efficiency centrifugal cleaners and screens which remove grit. The material exiting the cleaners and screens is recovered

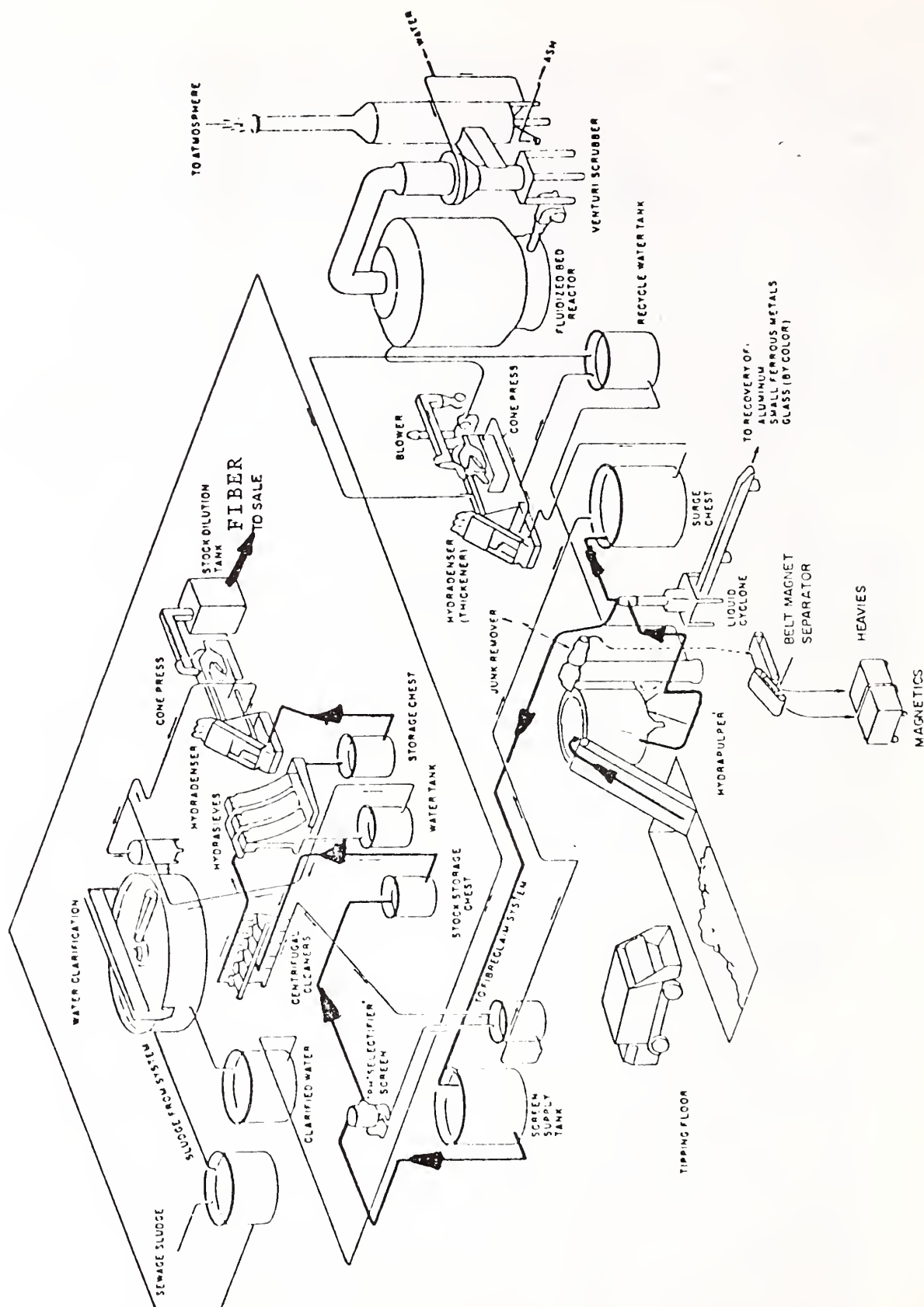


Figure 8-12. Wet Process Fiber Recovery System

fiber. This material can be washed and dewatered prior to shipment for use in a manufacturing process or for further beneficiation.

The economic viability of beneficiation processes is determined by the market for the recovered products. Generally, long-term contracts must be secured and the price of the upgraded fiber sufficiently higher than raw fiber to warrant the extra expense.

- 8.3.1.2 Dry Processing Concept - Paper Recovery. Another technique for paper recovery is displayed in Figure 8-13. The concept involves the recovery of paper using air classifiers to remove the paper fraction from shredded solid waste. The paper fraction removed by air classification is baled and either marketed in this form or further processed using a wet processing system similar to the wet process fiber recovery system.

As illustrated in Figure 8-13, the solid waste is first shredded followed by the removal of magnetics. An air classifier separates the paper and plastic from the remaining stream. If further air classifying to remove the plastic fraction were to be performed from the paper/plastic stream, it would be done at this time. However, the paper/plastic fraction can be baled and transported to the fiber processing plant without further processing.

The baled paper/plastic fraction is charged into hydropulpers and converted into a paper-water slurry. Plastics are removed when they become entangled on a hook immersed in the tank which is cleaned to remove this material at regular intervals. Heavy foreign matter and more plastics are removed by screening.

The fiber-rich pulp is discharged from the pulper to a hydracyclone to remove small particulate matter. The cleaned slurry is pumped to a prethickener where a large portion of the water is removed for recycling to the pulper. This thickened material is conveyed to a dewatering press where the material is concentrated to approximately 38 percent solids and additional water is recycled to the pulper. The fibrous material is then processed by mixing, grinding, and steaming, to remove unwanted paraffins and tar residues from the fiber product.

The recovered product is similar to that of the wet fiber recovery process and has limited marketability. It is estimated that approximately 23 percent of the input paper is recovered as marketable fiber.

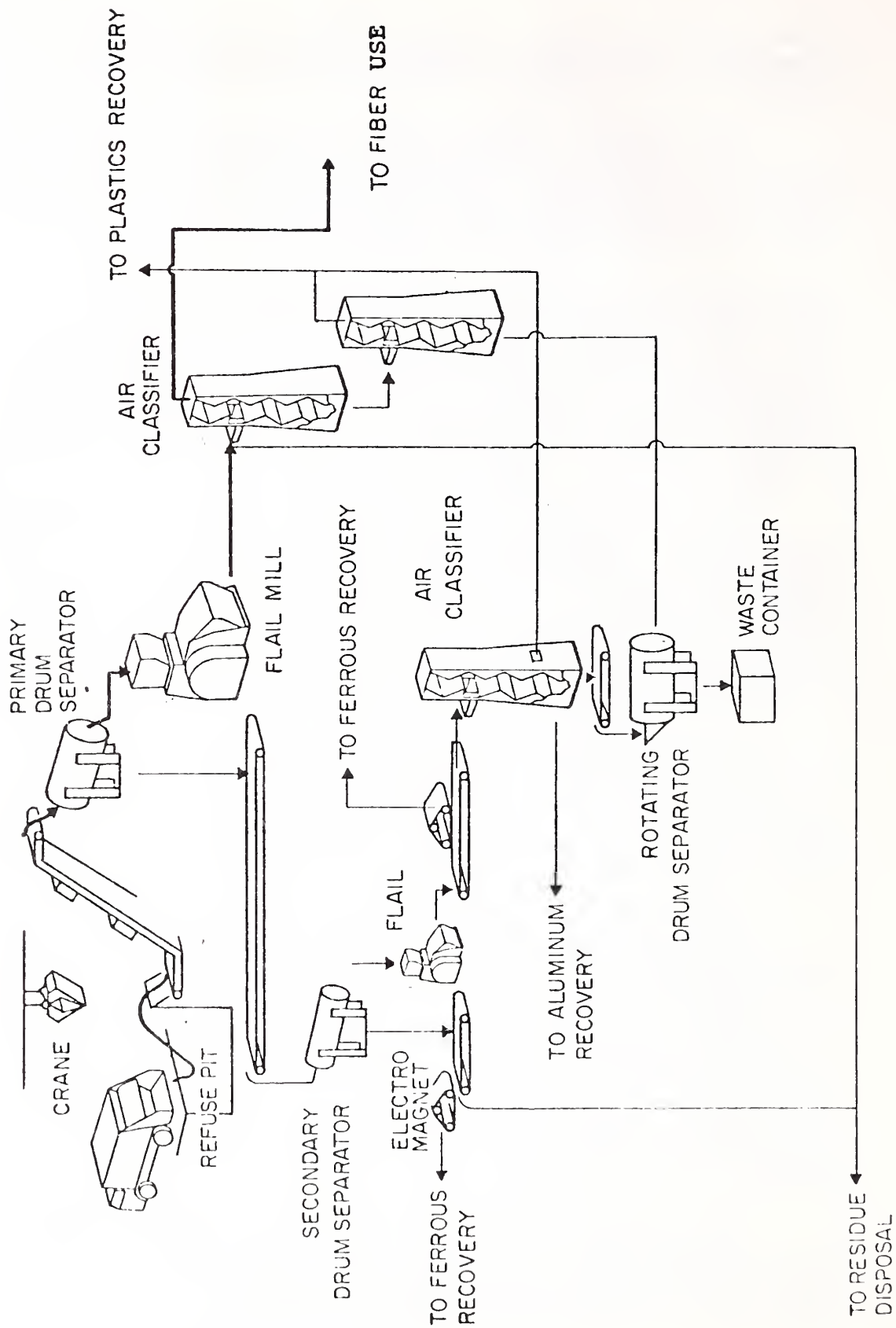


Figure 8-13. Dry Process Paper and Materials Recovery

- 8.3.1.3 Status of Development. A dry process paper recovery system which also prepares construction paper and board has been operating in Rome, Italy. The process is being marketed by Grumman Ecosystems Corporation and is based on several plants successfully operating in Italy.
- 8.3.1.4 Product Characteristics. The paper product as recovered from the air classifier can contain a significant amount of plastic, hence the marketability of this product is low. However, systems are under development to separate the plastic fraction from the light fraction using further air classification. The dry process, like the wet process, removes the plastic fraction from the air classified stream during the pulping step of fiber recovery.
- 8.3.2 Composting. Composting of municipal refuse is a method of converting the organic portion of mixed solid waste into a soil conditioner. Conversion is accomplished by the well known biological process called aerobic digestion. The humus which results from composted refuse can improve the tilth and moisture retention characteristics of poor soils. Clays are only temporarily improved by the addition of humus, but sandy soils can benefit substantially, especially in dry climates. Composting refuse has been practiced in Europe where intensive agriculture by specialty farmers and other small landholders is close to large towns and cities.

Three basic methods of composting are distinguishable; windrowing (digesting of the material in open stacks laid on the ground), tilling the undigested organics into soil containing mature compost, and completely mechanized industrial composting plants.

The first two processes require large amounts of land. The third requires mechanical equipment. The windrowing process can require as much as 30 days to achieve a mature compost, while the mechanical process can go to completion in two to five days (In most of the United States, 10 days are required because of the high paper fraction in mixed municipal waste.). Tilling of the undigested mix might show some undigested material after even one year under adverse conditions.

Composting processes require moisture addition and mixing to provide adequate aeration of the material. Efficient composting requires that the organic components in the solid waste be reduced to small particle sizes and that as much as possible of the inert materials be removed

from the waste stream prior to processing. The size reduction and inerts cleanup requirements for composting are almost identical to the processing requirements for production of fluff RDF. The same equipment can be used for both.

Since similar processing is required for the preparation of refuse for composting and RDF, and since RDF is expected to be more readily marketable than compost in an urban economy, it is unlikely that composting will be able to compete with energy recovery. Composted refuse is a very low grade fertilizer which cannot compete with chemical fertilizers. The high processing costs and the lack of a suitable market indicates that the composting of municipal solid waste is not a promising method of urban solid waste management. The possible exception is its use in sections of the country where sandy soils exist, such as in Florida.

- 8.3.3 Ferrous Metals Recovery. Ferrous metal reclamation is a subsystem which can be incorporated into almost all energy and materials recovery systems. The technology for extracting ferrous metals is based on magnetic attraction of ferrous materials and is readily available. Magnetic separators used in solid waste processing have generally been adapted from equipment designed for large industrial applications such as automobile salvaging. As a result, much of the existing equipment is larger than that required for solid waste processing plants, where the ferrous content of the feed is 10 percent or less by weight.

Magnetic separation of ferrous metals from municipal solid waste is usually preceded by shredding to free the metal from bags and attachments. Particle size does not appear to be critical since existing equipment can easily remove most ferrous objects which appear in urban refuse. Bulky items such as appliances can be either manually sorted or shredded prior to magnetic separation. Heavy ferrous objects, such as motor casings which cannot be size reduced in most shredders, must be manually separated in any case to protect the size reduction equipment.

In general, two broad classes of magnetic separators are used in solid waste processing (Figure 8-14); suspended types and head pulley types. Suspended type separators, positioned over refuse feed conveyors, are used to remove ferrous metals from refuse which may or may not have been shredded. The recovered ferrous metal is contaminated with paper so that air scalping or secondary magnetic separation is needed to produce a marketable fraction. Head pulley type separators are employed as a means of secondary

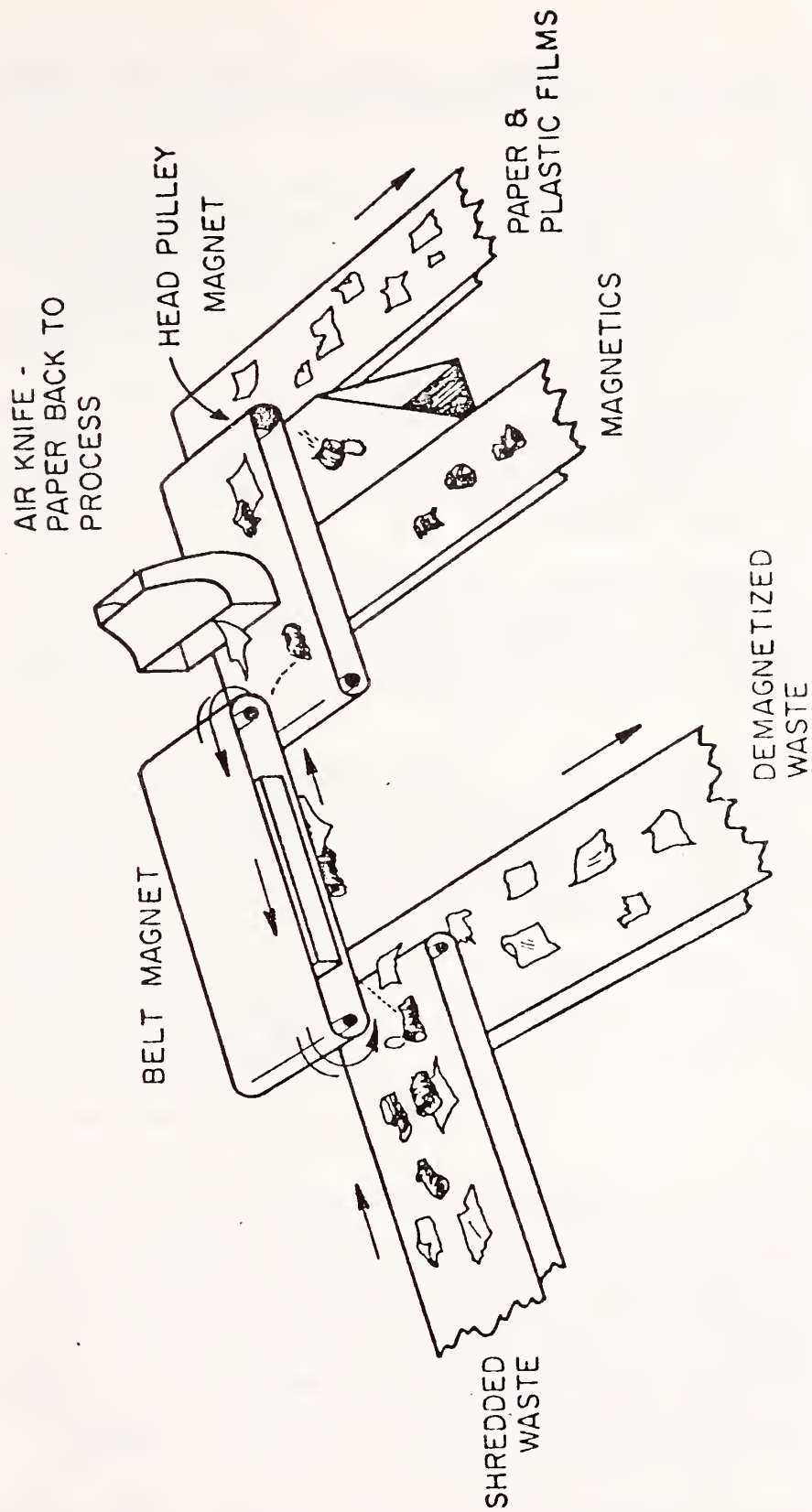


Figure 8-14. Magnetic Separator Configuration

ferrous separation. These are usually used after removal of ferrous materials by suspended type separators and size reduction.

The suspended magnet separator lifts ferrous metals from the waste and deposits them on a separate belt. The head pulley causes ferrous metals to follow the conveyor around the head and drop behind the refuse stream.

Theoretically, it would be possible to reclaim the entire ferrous content of the throughput. In actual practice, recovery rates of 90 to 97 percent of the ferrous materials have been achieved. The remaining fraction, consisting of fines resulting from shredding, is lost in the light fraction of air classification or is physically bound with other wastes.

- 8.3.3.1 Status of Technology. The technology of ferrous metals separation and reclamation is proven and has been demonstrated in numerous areas. Magnetic separation is being used in almost all operating and proposed energy and material recovery systems.
- 8.3.3.2 Product Considerations. There are five principal uses of ferrous scrap in the United States today; detinning, steel, copper precipitation and shredding, ferroalloy, and iron foundry. Each of these industries have different requirements. In any case, the scrap should be as free of contaminating material as possible.

In general, there is a market for post consumer steel scrap with greater acceptability if detinned; hence, magnetics should be recovered as open as possible (as opposed to balled up). After detinning, the clean ferrous scrap can be baled for the steel and ferroalloy industries, shredded for copper precipitation, or nuggetized for foundries.

It must be emphasized that the cost of magnetic separators constitutes only a small fraction of the costs involved with placing a ferrous metals recovery subsystem in operation. Major costs are incurred in providing support or auxiliary equipment for handling refuse such as shredders (or pulpers), conveyors, air classifiers (or liquid cyclones), etc. As an addition to an energy or fiber plant, however, its cost is minimal and the incremental investment usually is quickly repaid.

- 8.3.3.3 Glass Recovery Subsystems. Glass is recyclable if it is clean and can meet rigid specifications because its use allows glass container manufacturers to substantially

reduce the natural gas required to melt a batch of glass. Although glass is virtually problem-free in a landfill and the raw materials for glass manufacturing (silica sand, limestone, soda ash) are abundant, glass recovery is being proposed for many resource recovery systems. The principal drawback to glass recycling is that for many applications it must be color sorted; an expensive, developmental technology which, at present, is not capable of satisfying the rigid industry specifications. However, uses for mixed glass cullet are being developed.

Glass recovery subsystems operate on residues from dry or wet resource recovery systems. Among the specific glass separation methods in use or under development are: screening (vibrating or trommel screens) to recover mixed glass cullet; gravity separation (froth flotation, dense or heavy media separation, vibrating tables, mineral jigs) to separate stones and ceramics from glass cullet; inertial or ballistic separation; optical sorting of clean and colored glass fragments; and high intensity magnetic field color separation. To achieve a high degree of separation, it is usually necessary to use several of the above methods in combination.

- 8.3.3.4 Glass Recovery with Color Sorting. This system (Figure 8-15) is currently installed in Franklin, Ohio. This schematic reflects the latest design changes to improve the quality of the recovered glass product. The most recent of these modifications was completed in September, 1975, and included the addition of the dense media separator and the jig. The process is currently being evaluated to determine if the color-sorted glass end products will meet the market specifications required by the glass industry, and whether glass sorting is economically practical.

In this system, the heavy fraction from air classified dry shredded solid waste or the cycloned pulped light fraction is first washed and screened to remove fines. It is then passed under a magnetic separator where residual ferrous fragments are removed. The remaining material is then passed through a dense media separator where glass, stones, and metals sink and organic materials float and are removed from the stream. The sink fraction from the dense media separator contains mixed glass cullet, aluminum, ceramics, stones, and other nonferrous metals. It is processed in a water filled jig where aluminum and heavy metals are separated from the glass cullet, ceramics, and stones by a rhythmically pulsating current. The glass-rich stream is then dried, passed over a magnetic separator for further removal of magnetic material and into a high

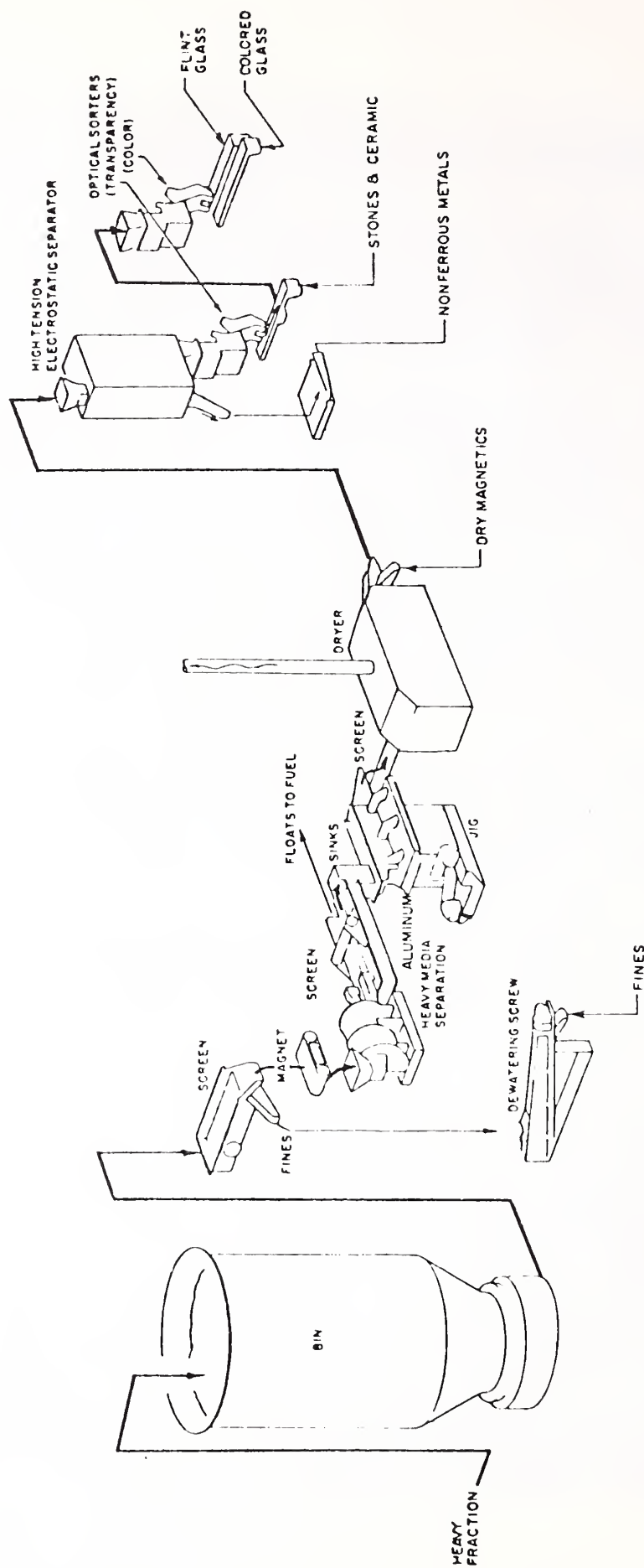


Figure 8-15. Wet Process Glass Recovery System

tension electrostatic separator where surface charges are induced on the remaining nonferrous metals. Magnetic fields are then used to separate charged metals from the glass. The metal-free, glass-rich stream is then passed through a transparency sorter where opaque materials are removed by an optical device which differentiates between the light transmission properties of transparent and opaque material. The glass fraction is subsequently processed in another type of optical sorter where clear (flint) and colored glass fractions are separated.

It should be noted that although it is easier to merely recover a mixed glass product, there are more markets for clean, color-sorted glass; hence, additional investment in a color-sorted glass recovery plant may be warranted.

There is one color sorting glass plant demonstration process located in Franklin, Ohio. While the process generally works, achieving high recovery rates and an acceptable product appear to be contradictory goals. The American Glass Manufacturing Institute is recommending that the cullet be clean and free of stones. They recommend a maximum of two stones per 100 pounds of cullet. As presently operating, the pilot plant is producing a much lower quality product. Extensive modifications and tests are being undertaken to remedy the problem. At the present time, color sorting is developmental technology.

- 8.3.3.5 Glass Recovery without Color Sorting. Because of the limited success in color sorting and because the market value of mixed color glass cullet is nearly equal to color-sorted glass, other mixed color glass recovery concepts have evolved. The processing concept shown in Figure 8-16 is a typical glass recovery system without color sorting.

The air classifier heavies from a dry fuel or paper recovery process are passed through a trommel screen (a rotating perforated cylinder) where the small particles (less than one inch), which are mostly glass, are separated from the remainder of the stream. The larger particles are processed in another line to recover aluminum and other nonferrous metals. The glass fraction is ground to a 1/16 inch top size and processed in a froth flotation chamber where the fine grit is separated from the mixed color glass cullet.

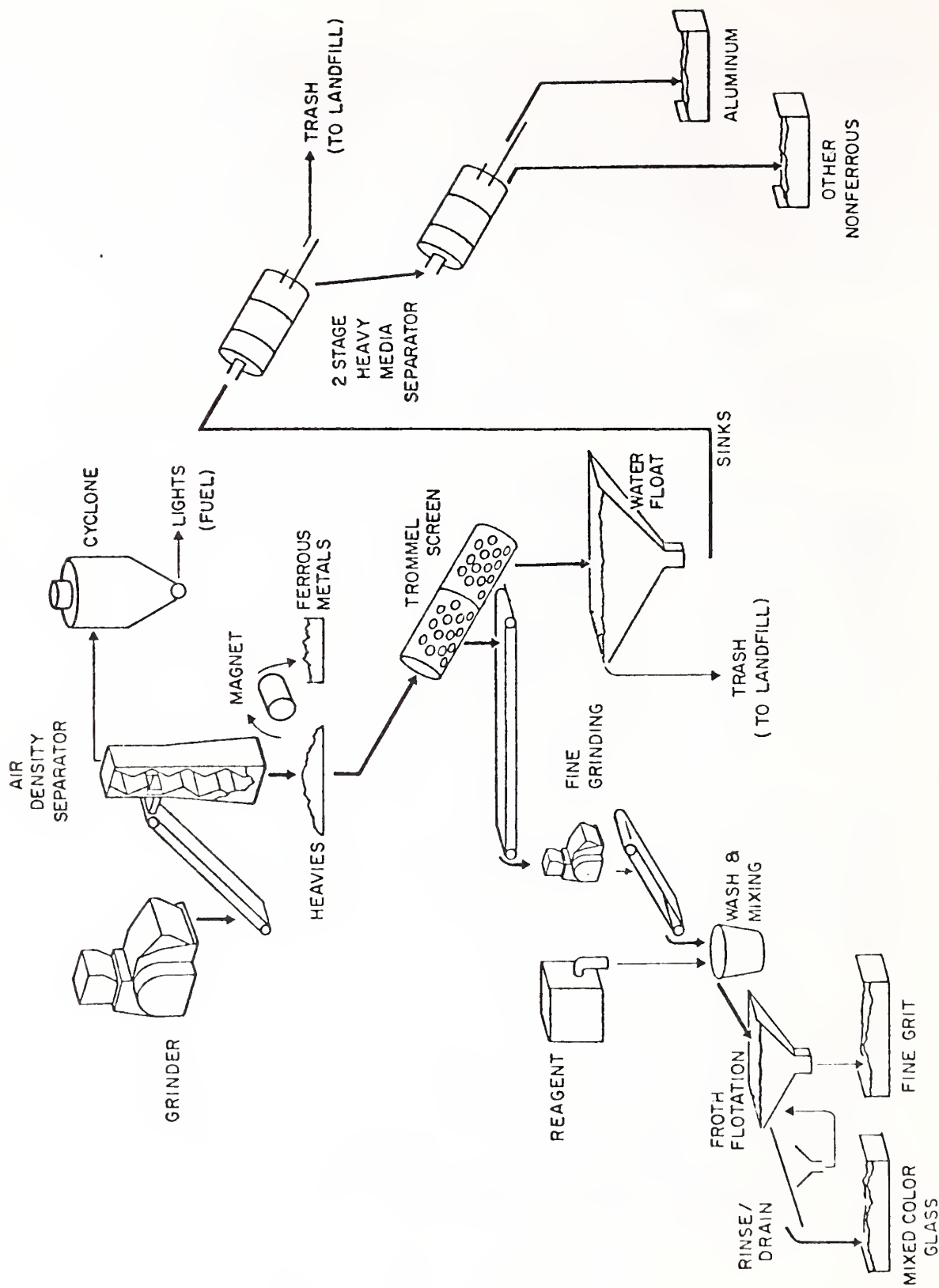


Figure 8-16. "Dry Process" Materials Recovery

Froth flotation involves the introduction of the fine ground glass stream into an aerated water bath. The bath contains chemicals which affect the surface of the glass particles so that they become air-avid or water-repellent. Vigorous agitation of the water-glass suspension in the presence of a frother causes the air-avid treated glass particles to rise to the surface where they can be removed. The stones, ceramics, and residual organics sink to the bottom of the froth flotation chamber. By carefully selecting the frother and agitation rates, a glass product capable of meeting the manufacturer's specification can be produced.

- 8.3.3.6 Product Considerations. Up to 90 percent of materials introduced into a glass manufacturing plant can be cullet. However, most glass container manufacturers would prefer to use only 10 to 15 percent cullet; this portion can be readily supplied by in-plant breakage as a clean cullet with known properties.

Clean glass cullet, whether color-sorted or not, is the most desirable product and can be sold at the highest price. Contaminants, such as aluminum, iron oxide, and ceramics significantly lower the value of the recovered glass. Low quality glass cullet can be used as an aggregate in glasphalt, glass brick, glass beads, glass wool insulation, wall panels and tiles, etc. Glass manufacturers and related industries are constantly identifying new products that can use recovered glass.

- 8.3.4 Aluminum Recovery Subsystems. Aluminum represents between 0 and 1.5 percent of the total weight of material in municipal refuse and consists primarily of cans and foils. Unlike magnetic metals, aluminum is costly to extract from mixed waste. However, the high market value of aluminum scrap, approximately \$300/ton, provides incentive for aluminum recovery.

Aluminum recovery cannot be accomplished without some preprocessing of the solid waste stream. Fiber or energy recovery processes usually provide an aluminum-bearing rejects stream with large amounts of other materials (glass, organics, ferrous, stones, etc.). Aluminum can be retrieved from the mixed inorganic stream by:

- (a) Gravity separation methods.
- (b) Electric or magnetic field separation methods based on the conductive properties of aluminum.
- (c) Chemical/thermal separation methods, such as sweating, froth flotation and cryogenic separation.

Recovery of all aluminum in mixed waste is extremely difficult. The limited amount of data available at this time indicates that approximately 60 to 80 percent of the aluminum waste stream can be recovered. Losses occur during various preprocessing steps.

One of the most promising of the above methods is the aluminum magnet. A recovery system utilizing an aluminum magnet is illustrated in Figure 8-17. When a conductor (aluminum, copper, silver, etc.) is exposed to a high frequency variable magnetic field, eddy-current phenomena arise. An induced magnet flux of opposite polarity is associated with these eddy currents. The interaction between the two opposing magnetic fields is a repellent force which will cause the conductor to move. Since only conductors are affected, aluminum can be separated. The intensity response to the imposed magnetic field is determined by the conductivity of the material in the field. Since aluminum cans and stamped plates have a higher conductivity than most of the other materials in the heavies stream (after ferrous metals have been removed), a reasonably clean aluminum can and foil fraction can be obtained.

If aluminum and glass are recovered jointly, the combined system may be more economically viable since these processes employ some of the same processing steps. The processing concept is displayed in Figure 8-16.

Regardless of the process employed, to be acceptable to primary aluminum producers, recovered aluminum must meet stringent specifications. The most troublesome contaminants in recovered aluminum scrap are stainless steel, zinc, magnesium and non-metallics (such as paint, oil, plastics, insulation, and rubber). These impurities decrease remelt efficiency and lower the value of the scrap.

- 8.4 Recommended Contract Conditions for a Resource Recovery Facility. Public agencies or regional authorities that undertake to engage a private enterprise, by contract, to execute a resource recovery program should consider the following conditions, as appropriate, when negotiating a contract.
 - 8.4.1 Enlist the services of experienced legal and financial counsel to develop a firm, reasonable contract and to delineate responsibility for risks and financial burdens.
 - 8.4.2 Retention of ownership of the facility site should be considered by the public agency or regional authority.

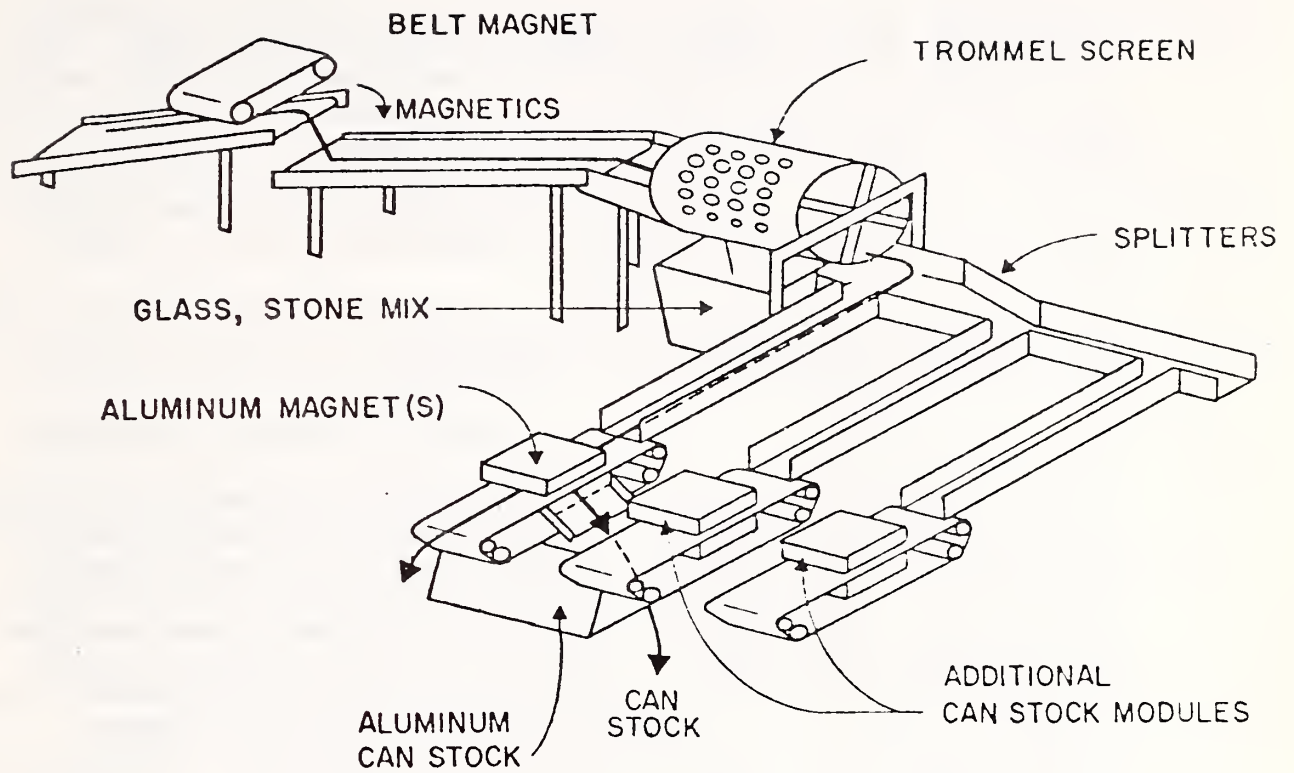


Figure 8-17. "Aluminum Magnet" Aluminum Recovery System

- 8.4.3 Purpose of the facility should be defined in terms of waste handling capacity, waste volume reduction and/or recovery quantities of recyclable materials including energy or product fuel.
- 8.4.4 A contract should specify a finite time for the operation of the facility, terms of lease, annual rental fees, rate of compensation and shares of all revenues received, hours per day, days of operation and/or maximum and minimum annual tonnage. Contracts should not be assigned.
- 8.4.5 Contractor should be advised of any special wastes or waste handling techniques that are or may become part of the required facility operations.
- 8.4.6 Construction, operation, and responsibility for any ancillary sanitary landfill should be specified.
- 8.4.7 Penalties should be set for contractor failure to perform or meet schedules. Such penalties may be in the form of loss of recovery revenues, no dump fee payments or liquidation of sustained damages. Operational guarantees may include penalties for not maintaining operational or maintenance standards. Such penalties could be in the form of a requirement for the contractor to pay minimum guaranteed revenue for recovered resources, regardless of the sales revenue. Variable dump fees can be related to plant performance level, decreasing with the level of resource recovery and/or volume reduction. Reduced dump fees should be in force during periods when the facility is inoperative and wastes are diverted to a landfill.
- 8.4.8 Public agencies or regional authorities should have the right to override a contract and assume responsibility for the facility if the contractor is unable, for any reason, to operate the facility for forty-eight (48) consecutive hours. Appropriate penalties or compensation may be charged to the contractor.
- 8.4.9 A binding and explicit long term contract with a financially responsible purchaser of the recovered materials, prior to commitment of capital funds.
- 8.4.10 The contract should specify the acceptable quantity, quality, price, transportation or transfer mechanism, and the term of agreement.
- 8.4.11 The public agency should retain the right to use, sell, or otherwise dispose of the recovered materials in the event the purchaser cannot accept them as specified in the contract.

- 8.4.12 Contractor should demonstrate his capability in the solid waste field, fiscal responsibility, skill of his management staff and operating personnel. He should describe the proposed process for handling solid waste, daily operating plan and equipment involved. Provisions for training management and operational personnel should be a condition of the operating plan. The legal status of the contractor should be that of an independent contractor and lessee.
- 8.4.13 The contractor should keep facility site and structures free of any and all liens and encumbrances. He should maintain complete and accurate books of account and operational records which should be available for inspection.
- 8.4.14 Types of resources to be recovered initially and ultimately, such material to be described according to accepted business usage. Product fuel, solid, liquid or gas, should be described by standard terms for chemical analysis, Btu value, moisture and ash content.
- 8.4.15 The contractor should have firm price and acceptance commitments from buyers of the recovered materials and product steam or fuel. These commitments should be obtained before the facility contract is finalized. When waste processing results in a product fuel, use of the fuel should be specified; i.e., to be sold by contractor, used to make steam or burned on site. Fuel not sold should be consumed by the facility process.
- 8.4.16 Funding, design, construction and operation of the facility should be the responsibility of the contractor. All phases of the construction and operation schedule should be specified and subject to approval of all agencies having jurisdiction over construction, testing, and commencement of operations.
- 8.4.17 Construction and performance bonds and liability insurance should be in effect by the contractor for appropriate amounts involved in the construction and operation of the facility.
- 8.4.18 The contractor should have the responsibility for hiring all necessary personnel; providing all machinery and equipment required for the design, construction, and operation of the facility; and obtaining all necessary permits and licenses.
- 8.5 Community Recycling Centers. Public agencies may directly operate community recycling centers or contract for their operation by private organizations on a semi-permanent basis or allow intermittent operation of such centers by volunteer groups. Due to the intermittent type of operations conducted

by volunteer groups, it is recommended that continuous operation of recycling centers be undertaken by public agencies for maximum effectiveness. Development and operation of recycling centers should be established by local regulation and in accordance with the following.

- 8.5.1 The center should be located for accessibility; must be neat, safe, and comply with all applicable regulations.
- 8.5.2 The site should be able to accomodate trucks, storage containers and the numerous vehicles that may bring materials at peak periods. It should not interfere with adjacent activities.
- 8.5.3 Types of materials and firm commitments from buyers for the materials should be clearly defined. Any revenue sharing between the private contractor or volunteer group and the local governmental agency should be specified in an agreement by these parties.
- 8.5.4 Safe and proper methods for handling each type of material should be made known to workers at the site. Short-term storage of materials should be done in an environmentally sound manner, safe from vandalism and theft. Arrangements should be made for the prompt removal of all materials.
- 8.5.5 Appropriate performance bonds and/or liability insurance should be a prerequisite for operation by a private contractor. Liability insurance should be considered for volunteer citizen groups.
- 8.5.6 Public agencies should provide and encourage area-wide support of all recycling efforts through publicity, appropriate ordinances, tax incentives, enlisting aid of local business enterprises, and supporting the use of recycled materials in manufacture of products.

9.0 PUBLIC FINANCING

Public agencies draw from two sources to obtain capital for facilities and equipment; revenue and borrowing. A third alternative is to contract with private enterprise for the service and shift the capital-raising burden onto the private firm performing the service. The local government must select the method that best fits a particular situation.

- 9.1 Revenues. Current revenue or capital budget financing is based upon the "pay as you go" philosophy; that is, all purchases are paid for as they are incurred. This practice is common in solid waste management. It is used mainly to purchase collection vehicles and selected landfill disposal sites.

The principal advantage over other forms of financing is simplicity. It requires few institutional, informational, analytical or legal arrangements. It is constrained by the capability of the local government to raise surplus capital and, therefore, may be unsuitable to finance large-scale capital purchases.

- 9.2 Borrowing. Borrowing is the second alternative to finance purchase of equipment and facilities. Basically, borrowing options may be divided into two categories.

- (a) Short and medium term options (one to five years) that purchase assets that cost less than \$500,000.
- (b) Longer term options (up to 30 years) that finance purchases over \$500,000.

- 9.3 Short and medium term financing alternatives are a limited source of funding for capital intensive purchases unless a jurisdiction generates large revenue surpluses. That is, cash payouts to pay back the principal on a loan are too heavy a drain on the city's cash flow. Examples of short and medium term borrowing instruments are bank loans and most leasing agreements.

- 9.4 Long Term Obligations should be used to finance purchase of expensive assets. One of five mechanisms can be chosen.

- (a) General obligations bonds
- (b) Revenue bonds
- (c) Industrial revenue bonds
- (d) Leasing
- (e) Leveraged leasing

Each of these methods have different advantages and disadvantages and real and associated costs. These five instruments are described in the following sections.

- 9.5 General obligation bonds (G.O. bonds) are long-term obligations secured by the "full faith and credit" of a political jurisdiction which has the ability to raise taxes. The full-faith-and-credit pledges the general revenue of that jurisdiction. The jurisdiction's revenue sources may include property taxes, sales taxes, unincorporated business taxes, personal property taxes, taxes on gross receipts of designated businesses, license fees and other charges, grants-in-aid from the federal government, and tax-sharing distributions from the State (excluding Federal revenue-sharing receipts).

Interest paid on general obligation bonds is non-taxable, both State and Federal.

- 9.5.1 Characteristics. A typical G.O. bond is offered competitively. A competitive offering allows various investment banking houses (underwriters) to compete against each other for the right to market the bonds. The underwriting syndicate that offers to buy the entire issue at the highest price wins the right to place the bonds.

Interest rates on general obligation bonds currently vary around six percent. Exact interest cost to the jurisdiction depends upon its credit rating and availability of money in the capital market.

The lead time necessary to raise monies through general obligation bonds may be long or short. It is primarily a function of the time it takes a jurisdiction to inform its constituents and to hold an election. The capital markets credit evaluation does not cause any significant delay.

The effective minimum offering size for G.O. bonds is approximately \$500,000. General obligation bonds can be used to finance any project. If a project cost less than \$500,000 and G.O. financing is still desired, grouping it with several other projects will raise the total monies required over the minimum offering size.

A G.O. bond offering is usually a serial bond issue which allows the principal to be repaid periodically over the life of the bond. For example the outstanding debt may be retired in partial payments in years 20 through 30.

The longest period of maturity for G.O. bonds is usually 30 years. A "call" provision may be included to allow repayment of the principal early, should market interest rates change to the point where a refinancing will save on interest charges. If this path is followed, a penalty payment is usually required.

9.5.2 Advantages. Financing solid waste facilities through G.O. bonds has two main advantages.

- (a) Low interest rates. They have the lowest interest rate because the risk to the investor is minimal since he has recourse to the city's tax collecting capacity and the interest on the bond is tax-free which greatly increases the effective aftertax yield to the investor.
- (b) Minimal financial analysis. The market evaluates the credit-worthiness of a jurisdiction and does not evaluate the risk of a particular project. Initially, this should especially benefit construction of resource recovery facilities, since market information on resource recovery plants is minimal and a higher rate of return of funds may be required.

9.5.3 Disadvantages. G.O. bonds have one main advantage. They often require voter approval. If voter approval is necessary, very infrequent, relatively large bond issues are the rule. The reason for this tactic is to minimize the number of time-consuming, cumbersome and costly publicity campaigns needed to undertake to raise capital. Where voter approval is not required, it is not unusual to go to the bond market quite frequently (twice a year).

9.5.4 Constraints. Florida does have limitations on the amount of debt its cities may assume. This "debt ceiling" is usually a function of the city's total assessed property value. Some cities have used G.O. bonding to their legal limits. Cities can and have before, bypassed this restriction by reassessing property values upwards. However, reassessing property values is not popular with the voters.

Economies of scale definitely exist in the general obligation bond capital formation process. It was mentioned before that the effective minimum offering size is \$500,000. Smaller amounts are not feasible because the transaction costs (which are essentially fixed below \$1 million) make the effective interest rate very high. The marketability of the issue market is better with a larger offering.

9.6 Revenue Bonds, General Discussion of Conventional Type. These, like general obligation bonds, are long-term, tax-exempt obligations issued directly by municipalities, authorities, or other quasi-public agencies. Unlike general obligation bonds, they do not contain a "full-faith-and-credit" clause which pledges the issuer's general tax revenue to guarantee the schedule of interest and principal payments. Rather, they pledge the net revenue generated by a single project usually the project being financed, to guarantee payment of the funds obtained in the issue.

9.6.1 Characteristics. The typical revenue bond is negotiated rather than competitively underwritten. Negotiated interest rates, generally, are higher than competitive interest rates. However, some of these extra costs are off-set by the "free" advice the investment banker provides in his examination of the project and his preparation of the revenue bond circular. A revenue bond circular summarizes all necessary and pertinent information about the project for prospective purchasers of the bond. Usually the municipality will hire a consultant to confirm its own estimates of costs and revenues.

The effective minimum offering is approximately \$1,000,000. Revenue bonds have a higher minimum offering than G.O. bonds because the market must perform a detailed technical and economic analyses before issuance since the bonds are not secured by the full-faith-and-credit of the community.

9.6.2 Advantages. Revenue bonds have three major advantages.

- (a) Voter approval not required. This will eliminate the incremental costs from holding an election and may tend to reduce the lead time necessary to float a loan.
- (b) Municipal debt limitations do not apply. Projects, therefore, will not be constrained by a city's current debt situation.
- (c) Financial responsibility encouraged. The buyers of the bond act as another check on the financial capability of the project by also evaluating the credit worthiness of the particular project the bonds will finance.

9.6.3 Disadvantages. Revenue bonds have three main disadvantages.

- (a) Their complexity is predicated upon the necessity of having a detailed revenue bond circular. The circular is necessary because prospective buyers must have sufficient information to assess the certainty of the projected revenue stream.
- (b) They are only suitable for financing projects that cost more than \$1 million due to their heavy fixed administrative and transaction costs.
- (c) Interest rates are higher than general obligation bonds. Therefore, cost of money and future demands on a city's cash flow will be greater. Revenue

bonds pay higher interest rates because the investor assumes a higher risk when he invests in them. In some cases revenue bonds have been designed to have the same risk attributes as G.O. bonds. Then, interest rates are comparable to those of G.O. bonds.

9.6.4 Constraints. A revenue bond can only be used for single project financing. This method is used only when a major project, requiring long-term capital, is to be managed by an independent authority or a distinct agency, and when the service provided will generate enough revenue to operate and maintain the facility as well as pay the interest and retire the debt.

9.7 Florida State Revenue Bonds. Article VII Section 14 of the Florida Constitution allows revenue bonds, backed by the full faith and credit of the State, to be issued for pollution control and abatement facilities. The following are excerpts of sub-section of Section 14 Article VII and; sub-section of 403.1834, Florida Statutes.

9.7.1 Scope of authority; Subsection (a).

"SECTION 14. Bonds for pollution control and abatement facilities.--

- (a) When authorized by law, state bonds pledging the full faith and credit of the state may be issued without an election to finance the construction of air and water pollution control and abatement and solid waste disposal facilities (herein referred to as "facilities") to be operated by any municipality, county, district or authority, or any agency thereof (herein referred to as "local governmental agencies"), or by any agency of the State of Florida. Such bonds shall be secured by a pledge and shall be payable primarily from all or any part of revenues to be derived from operation of such facilities, special assessments, rentals to be received under lease-purchase agreements herein provided for, and other revenues that may be legally available for such purpose, including revenues from other facilities, or any combination thereof (herein collectively referred to as "pledged revenues"), and shall be additionally secured by the full faith and credit of the State of Florida."

9.7.2 Statutory authority; Section 403.712, Florida Statutes.

"403.712 Revenue bonds.--

- (1) Revenue bonds payable from funds which result from the revenues derived from the operation of such solid waste recycling facilities and from any revenues which may be pledged under s. 14, Art. VII, State Const. and s. 403.1834, including, without limiting the generality of the foregoing, any legally available revenues derived from public or private sources, may be issued by the Division of Bond Finance of the Department of General Services on behalf of the state or any county or municipality in the manner provided by the State Bond Act, ss. 215.57 et seq., except as otherwise provided herein, and the Revenue Bond Act of 1953, as amended, part I, chapter 159. Such bonds shall be issued only to finance the cost of construction, maintenance, or operation of resource recovery and management facilities, which cost may include the acquisition of real property and easement therein for such purposes.
- (2) Upon a determination by the Division of Bond Finance of the Department of General Services that a public competitive sale is not feasible or that it would not be desirable to award such revenue bonds solely on the basis of the lowest net interest cost bid, the Division of Bond Finance may negotiate the sale of any such revenue bonds after the receipt of one or more proposals, taking into consideration the lowest total cost and such other factors as may be deemed appropriate."

9.7.3. Constraints

9.7.3.1 Debt service coverage limitation; Subsection (b).

- "(b) No such bonds shall be issued unless a state fiscal agency, created by law, has made a determination that in no state fiscal year will the debt service requirements of the bonds proposed to be issued and all other bonds secured by the pledged revenues exceed seventy-five per cent of the pledged revenues."

9.7.3.2 Security agreement; Subsections (c) and (d).

- "(c) The state may lease any of such facilities to any local governmental agency, under lease-purchase agreements for such periods and under such other terms and conditions as may be mutually agreed upon. The local governmental agencies may pledge the revenues derived from such leased facilities or any other available funds for the payment of rentals thereunder; and, in addition, the full faith and credit and taxing power of such local governmental agencies may be pledged for the payment of such rentals without any election of freeholder electors or qualified electors.
- (d) The state may also issue such bonds for the purpose of loaning money to local governmental agencies, for the construction of such facilities to be owned or operated by any of such local governmental agencies. Such loans shall bear interest at not more than one-half of one per cent per annum greater than the last preceding issue of state bonds pursuant to this section, shall be secured by the pledged revenues, and may be additionally secured by the full faith and credit of the local governmental agencies."

9.7.3.3 Aggregate debt limit; Subsection (e).

- "(e) The total outstanding principal of state bonds issued pursuant to this section 14 shall never exceed fifty per cent of the total tax revenues of the state for the two preceding years.

9.7.3.4 Applicable subsections of Chapter 403.1834, Florida Statutes.

Annual bond limit; Subsection (3).

- "(3) The amount of the state bonds to be issued shall be determined by the Division of Bond Finance of the Department of General Services. However, the total principal amount issued shall not exceed two hundred million dollars in any state fiscal year."

9.7.3.5 Projects; Subsection (4).

"(4) The facilities to be financed with the proceeds of such state bonds shall be determined and approved by the Department of Environmental Regulation, and may be constructed, acquired, maintained, and operated by any county, municipality, district, or authority, or any agency thereof, or by said department."

9.8 Industrial Revenue Bonds. Industrial revenue bonds (IRB) are issued by a municipality for or on behalf of a private enterprise. The municipality acts as a vehicle through which a corporation may obtain low cost financing.

A limitation of industrial revenue bonds is that IRB's can only be used to raise a maximum of \$5 million in capital; this money must be targeted for industrial development.

9.8.1 Characteristics. With an IRB, the municipality technically owns the facility and equipment which it then leases to the private firm. The lease payments are specified to meet the scheduled payments of debt and interest on the bond. If the payments between the corporation and the municipality are structured as an "installment sale," the corporation may claim ownership for tax purposes. This gives the corporation tax benefits in the form of accelerated depreciation and/or investment tax credit.

Industrial revenue bonds are not backed by the "full-faith-and-credit" of the municipality. They are secured only by the assets of the corporation. The credit rating of the corporation determines the cost to that corporation of an industrial revenue bond. Interest rates on industrial revenue bonds are higher than on G.O. bonds.

9.8.2 Advantages and Disadvantages are the same as for municipal revenue bonds. The major distinction is that the latter two mechanisms finance a corporation's facility construction. Theoretically, the savings in interest the corporation realizes by use of these tax-exempt instruments will be passed on as savings to the municipality through lower service fees.

9.8.3 Constraints. In the solid waste field these mechanisms have seldom been used. The administrative complexities and broadly defined tax guidelines frequently require IRS rulings. This may delay final financing by six months. A major stumbling block of industrial revenue bonds is a jurisdiction's ability to sign long-term contracts with corporations, guaranteeing a minimum supply of solid waste.

9.9 Leasing. Traditional leasing is used more to finance medium to longterm use of capital equipment. A lease arrangement involves a third party (lessor), who purchases an asset with his own money, and the jurisdiction (lessee), who rents use of the asset. The length of a lease usually does not exceed beyond five years, though some leases recently have been made for 20 years.

9.9.1 Advantages. Leasing has two main advantages over other forms of conventional capital financing.

- (a) Demand on municipal capital outlays can be reduced. It allows the municipality use of an asset without forcing the city to raise the capital "downpayment" necessary to purchase the asset. The city pays for use of the equipment in yearly rents.
- (b) Lease financing can be instituted rather quickly. There are few institutional road-blocks that may delay the financing.

9.9.2 Disadvantages. Leasing has two major disadvantages.

- (a) Lease rates are high. Current rates range between 9 and 18 percent of the capital cost of the equipment. This contrasts with a lower effective interest rate on tax-exempt bonds.
- (b) After the termination of the lease, the city will not own or control the facility. This disadvantage can be reduced if in the leasing contract the city stipulates options to either renew the lease or purchase the asset at fair market value at the end of the contract.

9.9.3 Constraints. There are some constraints that curtail the use of leasing as a financial instrument. The most notable constraint is the ability of jurisdictions to sign long-term contracts. There are some other specific laws which may limit its application in individual areas.

9.10 Leveraged leasing. Technically this is not a financial instrument. It is an arrangement that combines several financial options. The concept is based upon benefits (lower long-term capital and interest costs) that accrue to a jurisdiction if a financial intermediary, corporation or individual, is interposed between a long-term source of capital and the jurisdiction.

Leveraged leasing, using tax-exempt funds as a debt source, is a new concept that has only been applied twice in the municipal sector. Its future, however, is promising and it has stirred a great deal of interest in the public financing investment community.

- 9.10.1 Characteristics. Leveraged leasing is a most complex mechanism to initiate. It involves two major participants, a financial intermediary (lessor) and a city (lessee). It differs from traditional leasing in that both the lessor and the city provide capital funds to purchase the asset. Usually, the lessor puts up 20 to 30 percent of the cost of the asset and the city finances the remaining portion through a typical borrowing method.

The financial intermediary purchases the tax advantages of ownership, which are worthless to a city, by charging the city a very low interest rate on his share of the cost of the asset. He is able to provide funds to a municipality at a very low interest rate because he is the owner of the facility from a tax standpoint and can depreciate the investment to claim an investment tax credit provided the facility is run by a private corporation. Essentially, the depreciation and tax credit act to shelter the financial intermediary's other income, which allows him to receive an adequate after-tax return on his initial investment in the asset.

Usually in leveraged leasing, the lease is on a purely financial "net" lease basis. A net lease has the lessor act only as a financial intermediary. The lessee (the city) assumes responsibility for all future plant maintenance costs, improvement costs, etc.

- 9.10.2 Advantages. Leveraged lease financing offers two major advantages over direct ownership for a municipality.

- (a) Demand on municipal capital funds is reduced. A substantial portion of a projects required capital is supplied by a third party.
- (b) Interest charges are reduced. Tax advantages available to a third party lessor/investor permit him to supply capital at a very low cash return, while still maintaining his all important adequate aftertax return.

- 9.10.3 Disadvantages. Leveraged leasing has two main disadvantages.

- (a) It is new and legally complex. There have only been three leverage leases of municipal funds. Therefore, at least initially, lengthy rulings will be required from IRS.

- (b) At the end of the lease, the facility is owned by the lessor and not the city. At least in solid waste, the disadvantage will probably be minimal since the technology after twenty years (the term of the lease) may be obsolete. The jurisdiction can further minimize the disadvantage by stipulating options to purchase the facility at fair market value at the end of the lease or renew the lease. This decision depends upon whether the facility has any technical or economic value at that time.

9.11 Financial Consultants. An outside financial consultant can assist a jurisdiction in choosing a particular financing mechanism and the specific variations most suited to the circumstances. This task may be performed by independent consultants, commercial banks, attorneys, engineers, accounting firms, or investment banking firms.

Sometimes an outside party performs two separate functions, e.g., financial advisor and underwriter. In this situation, it may be difficult to provide an objective analysis since the underwriter/financial advisor stands to realize greater fees by recommending certain types of financial mechanisms. This risk will be minimized if all real and associated costs for each of the financing mechanisms are compared.

A financial consultant helps prepare the bond offering. His responsibility includes gathering all necessary data, preparing the bond circular, advising on timing and marketing methods, and recommending bond terms.

In a competitive offering, several underwriters are invited to submit sealed bids, with the variable being the effective interest rate. The jurisdiction must do the preparatory work or hire a financial consultant to do it. For a negotiated offering, most of this work is done by the investment banker. In many small or medium-sized cities, no municipal official has time or the specialized financial knowledge required to prepare offerings. An outside financial advisor is a necessity.

A financial consultant can be compensated in several different ways. If an independent firm or individual is hired, the charges will generally be a direct function of time spent. If an investment banker is chosen, he will receive his profit from the issuance of the bond.

9.12 Investment Banking Firms. The role played by the investment banking firms is rather straightforward. Their function is to act as a financial intermediary that purchases bonds from the issuing city or other governmental unit and, in turn, sells them to the ultimate investor. The underwriter assumes the market risk of price fluctuations during this period and performs a distribution function.

The investment bankers contact with a municipality depends on whether or not the bond underwriting is to be competitive or a negotiated bid. If competitive, it is not unusual for an underwriting syndicate to submit a bid without any direct contact with the municipality. If the municipality chooses to negotiate the underwriting, the investment banker acts as a financial consultant.

An investment banker charges a fee which is a percentage of the total bond underwriting. This fee can vary, of course, but on issues less than \$5 million, 2 percent of the total issue is a common rate. It is a smaller percentage for larger bonds. The commission is usually segmented into three categories: a management, an underwriting and a selling fee.

9.13 Bond Counsel. Another important party is the bond counsel. Their main role is to render an opinion regarding the validity of a bond offering. This legal opinion is virtually required on all municipal bond issues. The counsel must determine whether the bond issue is in compliance with all constitutional, statutory and charter provisions applicable to the municipality issuing the bond. The fee charged by the bond counsel, like that of a financial consultant, is a function of his time and the size and complexity of the underwriting. Generally, fees for general obligation bonds are somewhat less than for a revenue bond of comparable size. A typical bond counsel's fee for a medium-sized revenue bond (\$10 to \$20 million) may range between 0.3 percent and 0.4 percent of the gross amount of the issue.

9.14 Decision Making. There are three reasons for involving the financial community early in the decision making process.

- (a) Quick feedback. A financial advisor can act as an early screening agent, evaluating the financial risks of specific technologies.
- (b) Time saved. Some financing mechanisms (particularly tax-exempt bond leveraged leasing) require a long lead time if they are to be considered and implemented at all. Therefore, early contact is absolutely necessary if these mechanisms are to be used.

- (c) Free advice. The financial community will often give free advice especially if the bond to be floated by the municipality will be negotiated.

It should be noted that, unfortunately, this optimal approach seldom has functioned historically in this manner. Usually financial advisors and investment bankers have become involved only after the technology has been determined. This, in the least, is a waste of valuable resources.

10.0 SANITARY LANDFILLS

This section is intended to describe how to plan for and design a sanitary landfill, in very basic terms due to space limitations.

There are two classifications of solid waste. These are materials which are organic and putrescible or, inorganic and non-putrescible. Improper disposal of putrescible organic materials, including hazardous waste and residuals, can create public health problems.

Unless landfills are properly designed and operated, a disposal site can contaminate surface and underground water supply sources; pollute the air with objectionable odors, including smoke when burning is not prevented; produce flies, mosquitoes, and rodents; and depreciate the value of nearby real estate.

10.1 Planning.

- 10.1.1 Dump Closing and Conversion. In many Florida counties, convenience dumps have been established and located so that residents will not have to travel far to dispose of their solid wastes. The material in these dumps is usually covered at infrequent intervals, or not at all.

While it might be possible to convert these dumps into sanitary landfills that will conform to all existing regulations, it may not be practical, or economical.

Correcting the situation requires a study of the waste disposal problem in order to develop a long range plan. The plan would consider all aspects of disposal of garbage, rubbish, and other solid wastes.

Before a dump can be properly closed, an alternate acceptable disposal method and site must be planned, designed and constructed in accordance with Chapter 17-7, Part I.

- 10.2 Design. To properly design a sanitary landfill in Florida, a competent individual or firm familiar with the area's land resources, transportation, environmental factors and solid waste problems should be selected. It is preferable to have a county representative involved since they are usually familiar with the area.

- 10.2.1 Site Selection. Before purchasing a landfill site, it should be checked for suitability with Chapter 17-7, Part I, Florida Administrative Code (FAC), and the most economical method for meeting the criteria of that document.

Technical assistance for making a hydrogeological survey may be obtained from the Florida Department of Natural Resources, Bureau of Geology and the U.S. Geological Survey, or private consultant firms with such capability. Site selection should be based on satisfaction of the best hydrogeological criteria to provide greatest protection to water supply sources.

Due to Florida's rapidly growing population, the demand for land as well as its cost are skyrocketing. It is unfortunate that land most suitable for sanitary landfills is also the most desirable for development. The increasing cost of such land makes it imperative that for solid waste disposal be purchased in sufficient quantity to support sanitary landfill operations for as long as 20 years. Figure 10-1 is designed to give an approximation of the land volume required by the area per year using projected national waste generation averages. Those using the chart should study the following example.

A cell with 6 feet of refuse would have 6 inches of daily cover and 2 feet of final cover (25% cover) to give a depth of $8\frac{1}{2}$ feet. A sanitary landfill cell with 6 inches of daily cover, 1 foot intermediate cover, and 2 feet of final cover (approximately 50% cover) would by the same reasoning be $9\frac{1}{2}$ feet deep. Using the example in Figure 10-1, the land required for 10,000 people, generating 5.5 pounds per person per day with a compaction rate of 600 lbs/cubic yard and 25% cover would be 25.52 acre feet per year. Dividing the number of acre feet by the cell depth of 8.5 feet shows a requirement for 3.00 acres per year. Thus, for 20 years approximately 60 acres should be purchased.

- 10.3 High Water Table Problems. The major obstacle to creating a sanitary landfill in Florida is the high ground water table, and high average rainfall, both of which produce leachate. Leachate not only contaminates the shallow ground water, but may also contaminate the deep public water supply sources if it moves through a solution cavity or other opening in the aquaclude above the Floridan or other aquifer. If the water supply source becomes contaminated by leachate, then future treatment costs for drinking water will increase. If the contamination is severe, the wastes may have to be removed to prevent continuing degradation or the water supply abandoned.
- 10.3.1 High Water Table and Gas. Gas production is another factor which becomes a problem when solid wastes are deposited in the ground water table since gas production

FIGURE 10-1
ANNUAL LAND REQUIREMENT
(AREAS OF 5,000-25,000 POPULATION)

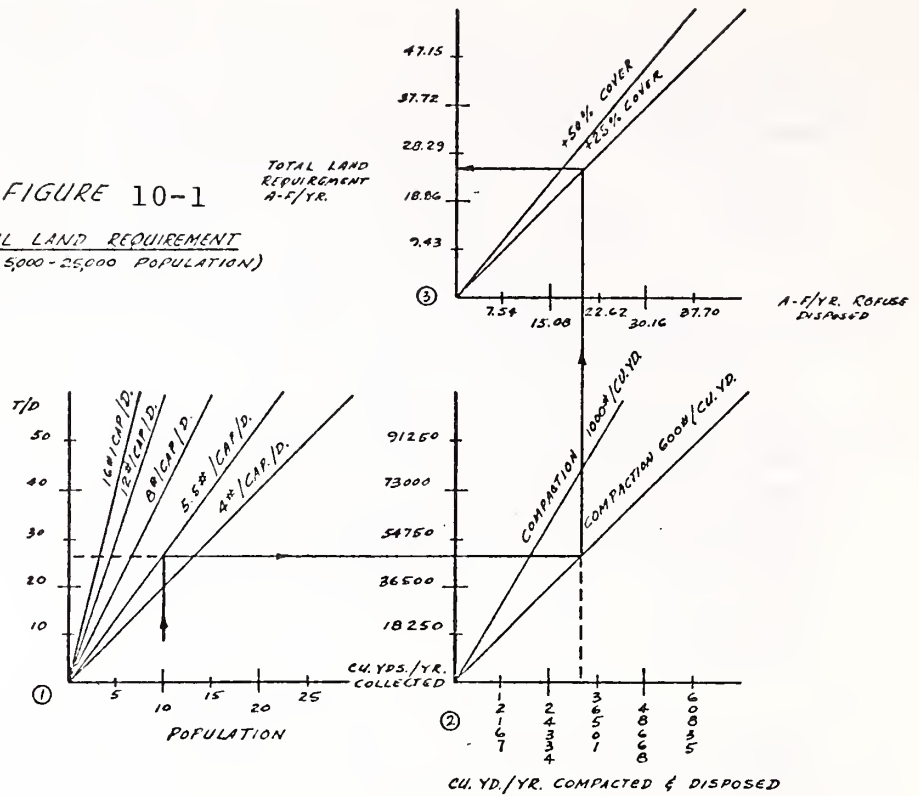
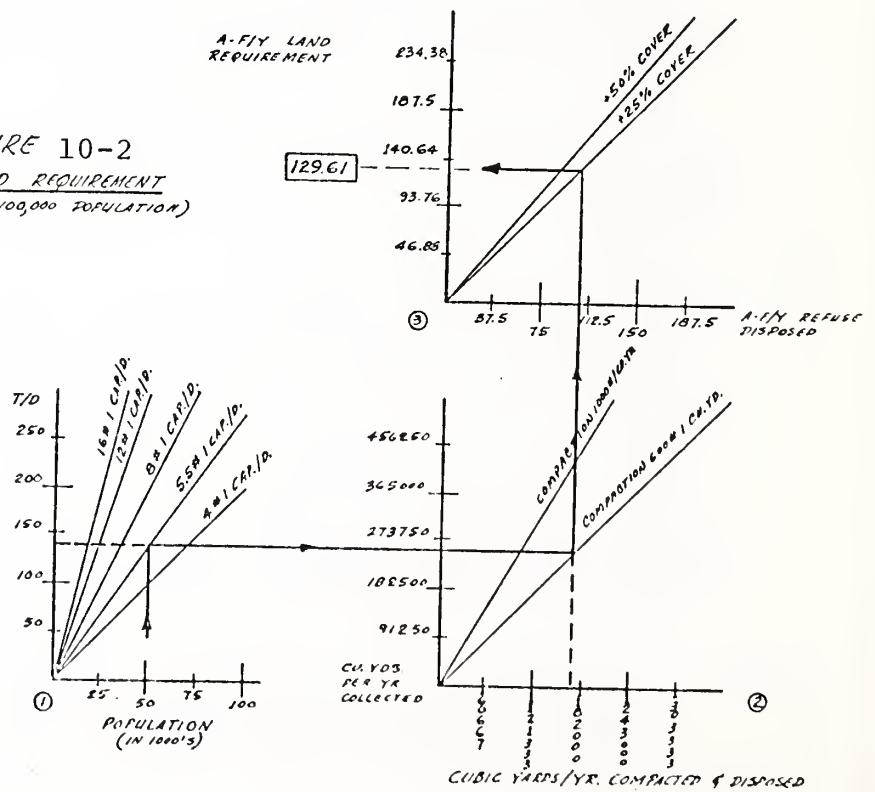


FIGURE 10-2
ANNUAL LAND REQUIREMENT
(AREAS OF 25,000-100,000 POPULATION)



increases with moisture content. Carbon dioxide, methane and nitrogen gases are produced by solid waste decomposition. Carbon dioxide can cause a problem in that it is heavier than air and is readily soluble in water thus increasing the hardness (mineral content) of the water. Methane gas is explosive in concentrations of between five and fifteen percent in the presence of oxygen. In a sanitary landfill, there is rarely any oxygen present when methane reaches these concentrations; however, if the surface of the landfill is covered with an impermeable soil such as clay or paving with no provision for venting, this gas can travel long distances underground and may enter buildings creating possible explosive hazards.

- 10.4 Soils. Soils play an important part in leachate quantities, movement and control. The soils in many parts of Florida are unsuitable for sanitary landfilling due to their high permeability. These soils permit water to penetrate the refuse cover thus increasing leachate and gas production. The most suitable soils are sandy loams or soils containing an amount of clay less than 40%.

The U.S. Department of Agriculture - Soil Conservation Service can provide information on the types of soils in your area. They are making good progress in classifying the soils of the state and soil surveys have been completed in many areas.

- 10.5 General Method. The general method of sanitary landfilling should be planned, designed and constructed in accordance with Chapter 17-7, Part I, FAC. An artist's conception of a landfill is shown in Figure 10-3.

The area intended for disposal of solid wastes should be divided into segments. Only the segment to be used immediately should be grubbed and cleared to control surface water run-off.

A perimeter ditch or some type of dewatering system may be used to intercept ground water; artificially lower the water table; to collect leachate; provide some oxidation and dilution of the leachate; and to collect storm run-off from the disposal areas.

A holding pond should be constructed near the perimeter ditch to hold the transferred liquid from the ditch. A pond is used to allow solids to settle out and to allow further oxidation of the liquid waste.

Upon completion of the operation, the site should be graded for drainage, and the perimeter ditches and holding pond monitored indefinitely, until leachate is no longer a potential pollution source.

10.6 Florida High Rise Method. In areas of high population and refuse generation, it is no longer economically feasible to purchase large sanitary landfill sites. One answer to conserving space is the construction of sanitary landfills above grade to form refuse mountains or plateaus 20 to 30 feet above the surrounding terrain.

The land requirements for a landfill to be constructed above grade, require excess acres to allow for excavation of cover material. This method can be used where the water table is high and cover material is scarce. The land used for cover material should be planned so that the excavated pit can be used as an oxidation or treatment pond. However, all precautions must be taken to prevent this pond from becoming a source of ground water contamination. A fabricated liner may be necessary.

The soil base should be well compacted to promote leachate run-off into the crushed rock filled channel (Figure 10-4) to the sump. The leachate is then pumped out through the buried drain pipe into the pond. In areas where soil is unsuitable, a liner of some type may be required. It will probably be necessary to treat effluent from the holding pond before discharging it into a receiving stream. Additional permits are required for discharging into State waters.

Leachate control for each set of lifts (one cell depth) is obtained by placing a vertical perforated pipe directly into the sump point for the drain pipe. The channels or pipe provide a path for leachate to the sump and the gas to the atmosphere. This system may be seen in Figure 10-4.

This method requires about fifty percent cover material in the form of six inches of compacted daily earth cover, one foot of intermediate compacted earth cover within seven days of cell completion, and a two foot final earth cover compacted in six inch layers prior to constructing the second layer of cells. Uneven settlement is reduced due to the extra material available to fill voids created by decomposing refuse.

Figure 10-5 shows a view of the site as the highest lift is completed and the other tracts which already have several sets of lifts on them are being readied for the next lift. Additional lifts are added in the same sequence as originally described to permit even settlement. It is recommended that side slopes (comprised of completed cells) not exceed 1 foot rise to 3 feet of run, to minimize erosion.

This method is recommended for areas with concentrated population and few well located sanitary landfill sites.

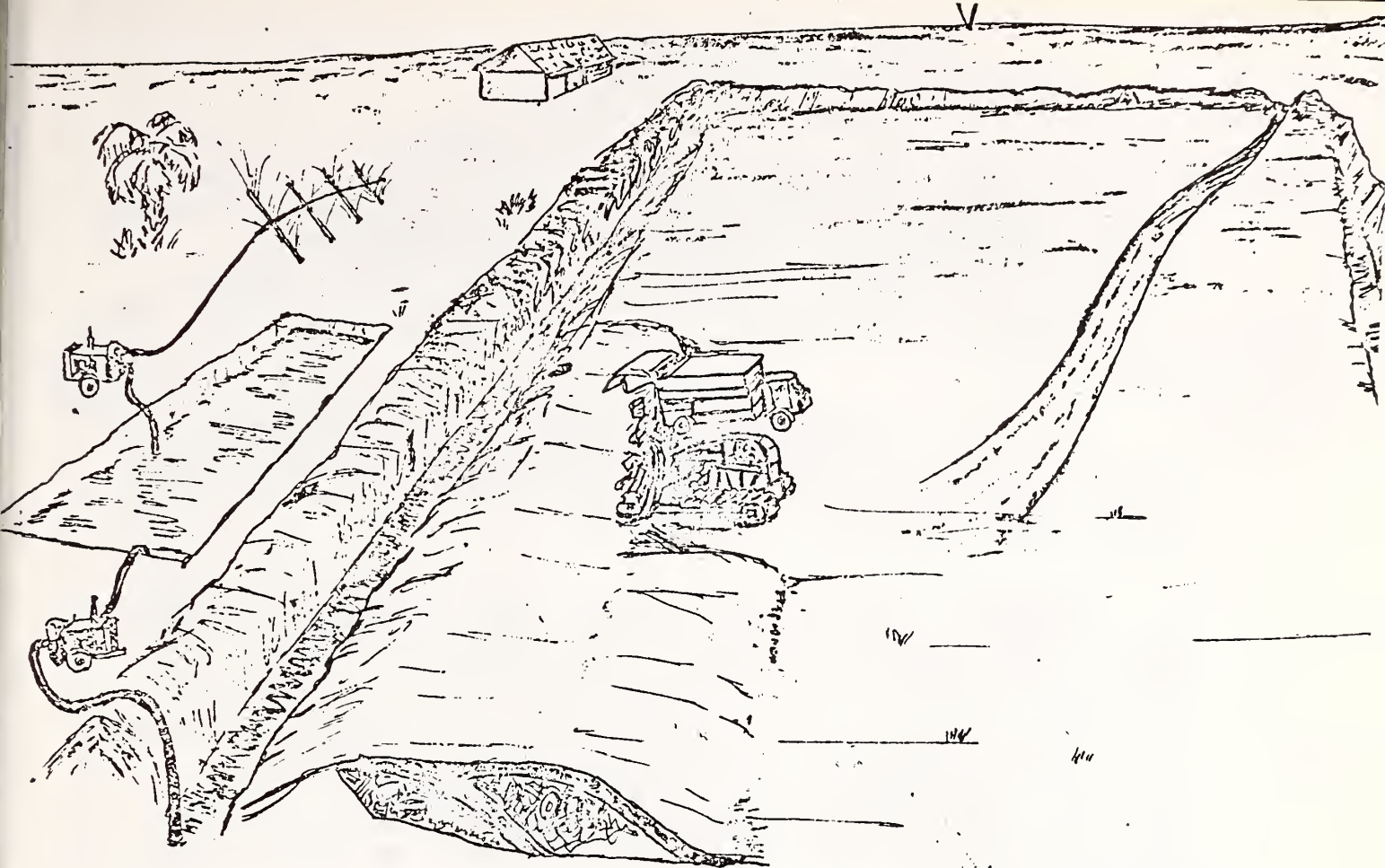
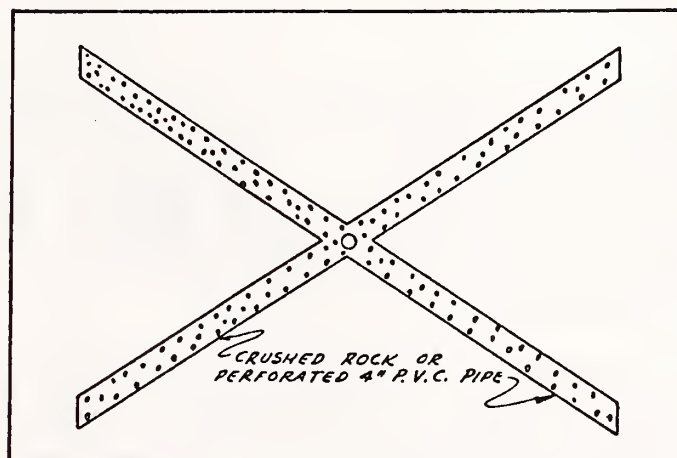


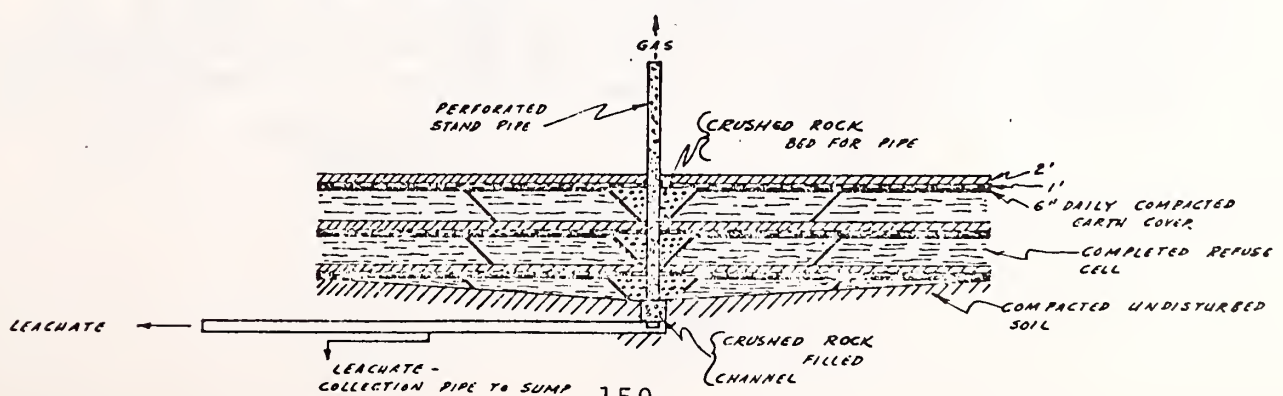
ILLUSTRATION OF
GENERAL METHOD

FIGURE 10-3

FIGURE 10-4



FLORIDA HIGH RISE METHOL
BASE PREPARATION AND
POLLUTION CONTROL SYSTEM



- 10.7 Wetland Method. The wetland method of sanitary landfilling is basically ideal for reclaiming marginal land where cover material is obtainable from a nearby source and a supply of construction debris or demolition rubble is available. It is a relatively inexpensive method which offers a degree of protection to the quality of natural waters. See Figure 10-6.

The first tract to be used should be surrounded by a perimeter ditch or dewatering system to lower the water table in the immediate area; to collect any leachate from saturated refuse cells; to collect storm runoff from the site; and to dilute the leachate.

Sanitary landfilling proceeds by first filling above the zone of saturation (water level) with compacted construction debris, and demolition rubble. After the zone of saturation has been filled with this compacted material, it should have an additional cover of one to two feet of soil to fill the voids in the rubble and reduce the amount of leachate entering the ground water table. Vertical or lateral movement is probable, therefore a liner will be required if the two feet of soil does not provide an impermeable barrier. Then sanitary landfilling of municipal refuse may be done on top of this material.

Cover material will have to be procured from borrow areas or obtained as spoil from construction projects.

The wet land method may be used as a base for the high rise method if control methods previously described are used.

- 10.8 Trench Method. The trench method of sanitary landfilling is most suitable in areas where a shallow ground water aquifer is located about 25 feet or more below the surface. In areas where this aquifer is less than 15 feet below the surface, this method even with pumping can result in contact between the refuse and the water, since the water table will again rise when pumping ceases. Contact can result in prolonged contamination of ground water.

This method is similar to the general method as far as digging perimeter ditches; a holding pond; and the use of a section approach, but this is where the similarity ends. Trenches are excavated to fifteen feet deep and one hundred to four hundred feet long, to provide a pit in which refuse cells can be constructed and cover material obtained. The refuse is compacted against one end of the

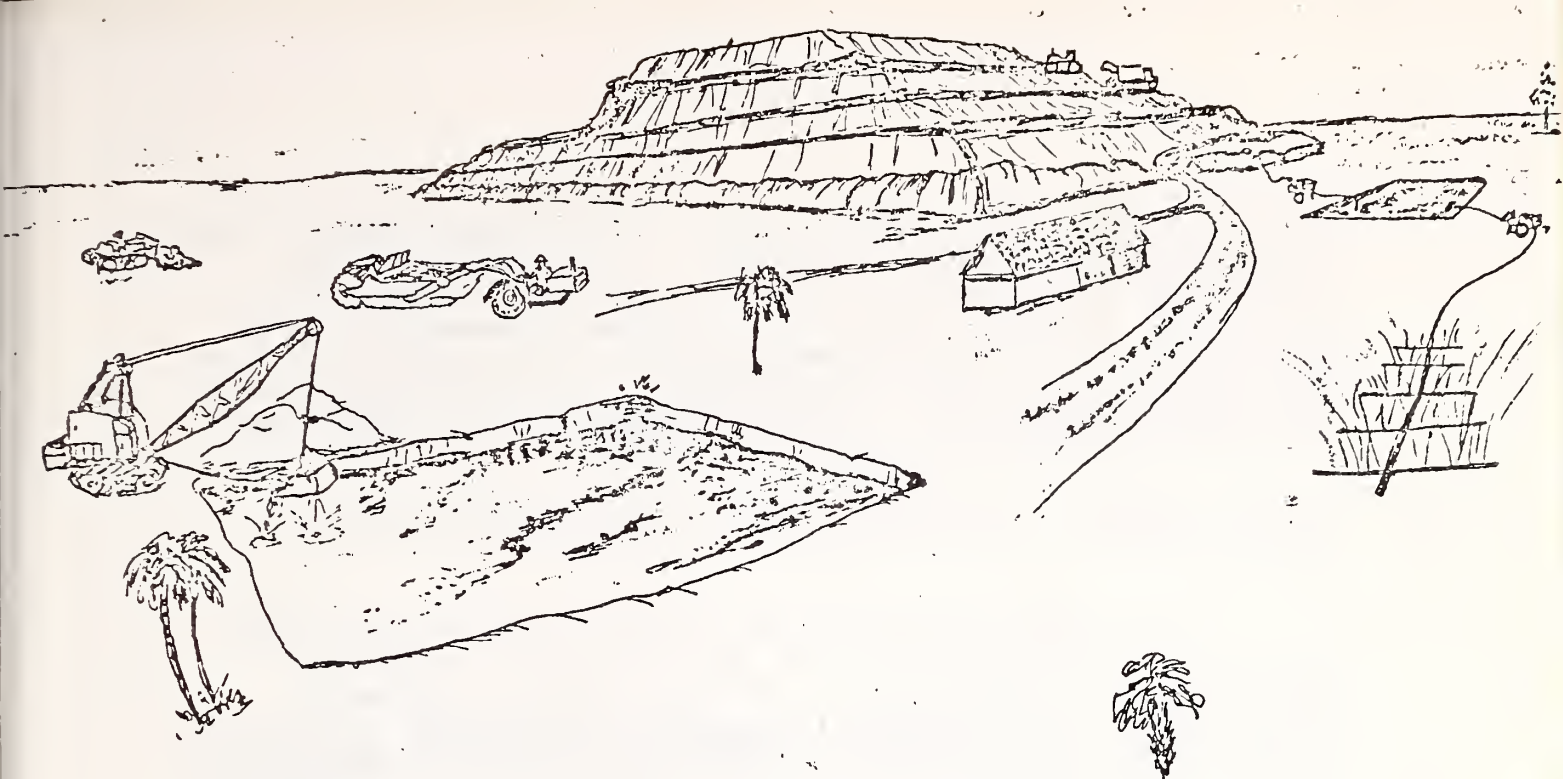


FIGURE 10-5

ILLUSTRATION OF
HIGH RISE METHOD

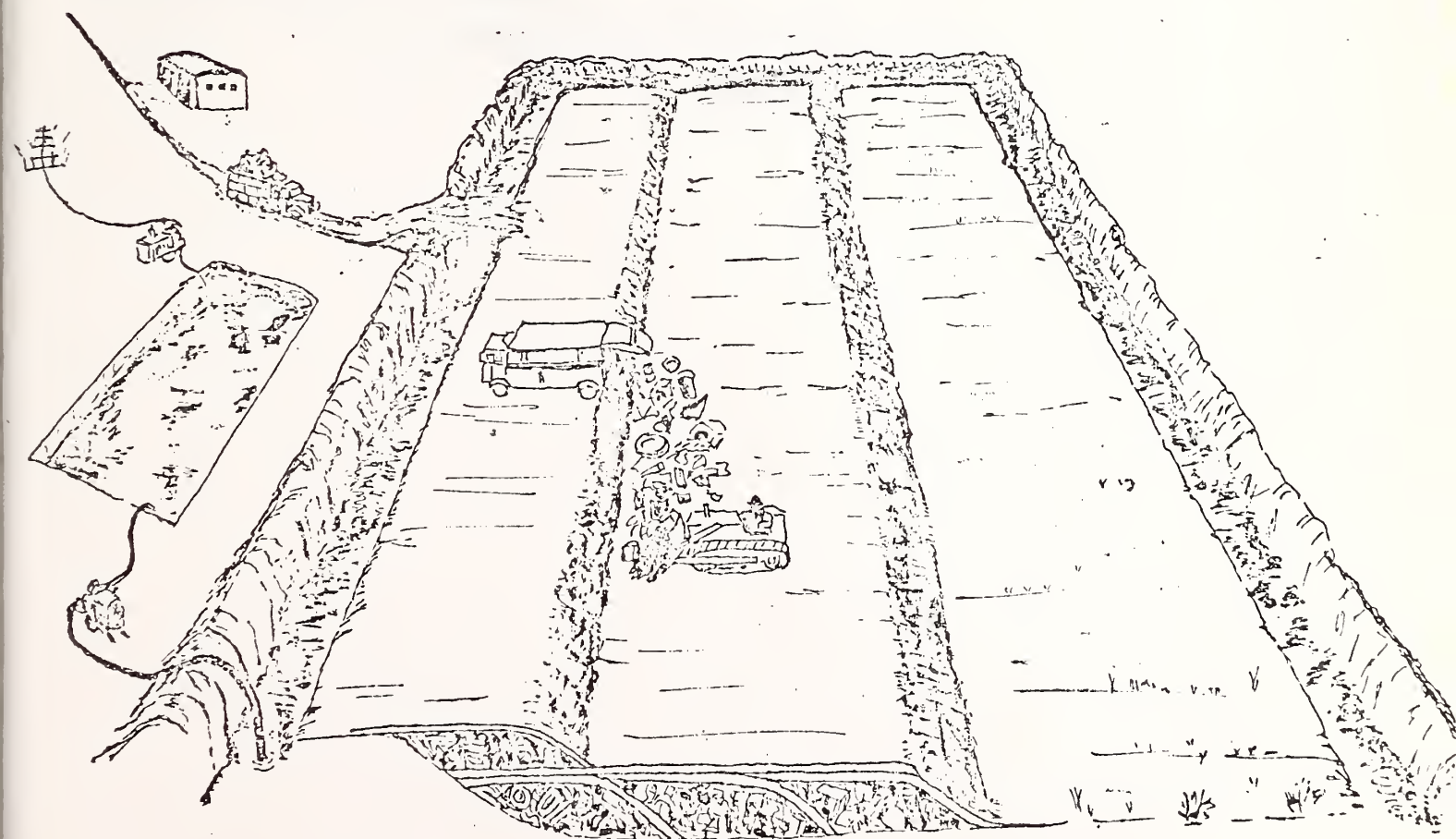


FIGURE 10-6

ILLUSTRATION OF
WETLANDS METHOD

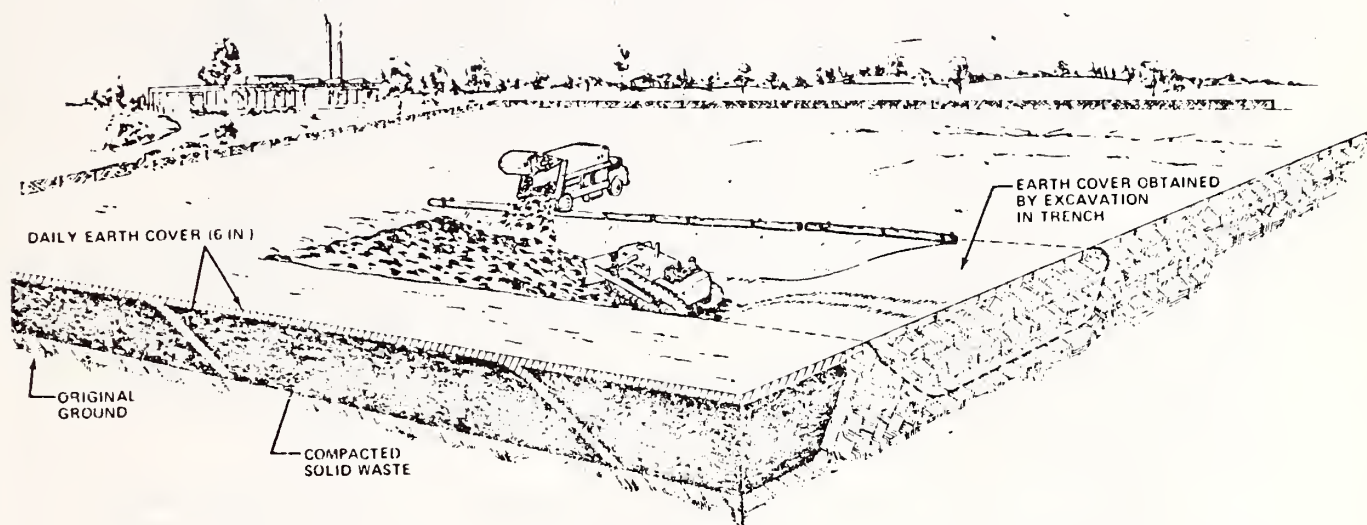
trench on an incline until a cell ten feet high and as wide as practical has been constructed. Each cell is then covered with six inches of earth cover each working day, or at more frequent intervals if deemed necessary. Upon completion of the trench, each lift should receive one foot of intermediate cover. Final cover is to be two feet as specified in Chapter 17-7, Part I, rules of the Department of Environmental Regulation. See Figure 10-7.

- 10.9 Design Outline. Sanitary landfill should follow the Department's rules in Chapter 17-7, Part I, FAC.

The guidelines should be closely followed by those having the responsibility for the planning, designing, operating, and administering of solid waste disposal. Proper solid waste disposal throughout the State will result in an improved environment, better protection of the public health, and a potential for an increased local tax income. Give solid waste a decent burial.

FIGURE 10-7

TRENCH METHOD



11.0 DISASTER PLAN

Disasters are rare natural or man-made events that cause severe damage. Disaster events cause loss of life to man, flora and fauna, and severely damage property or components of the natural environment which are highly valued by man. We are concerned with events whose probability is low but whose cost, should they occur, is high.

- 11.1 Mutual Aid Agreement. A mutual aid agreement with adjacent municipalities and counties is essential. Such agreements should include the temporary loan of both equipment and manpower, the designation of alternate disposal sites, the designation of supervisory personnel and the coordination with Civil Defense authorities, National Guard Company Commander, Health Department, local police and county sheriffs. The public agency should initiate the formation of a task force composed of representatives from the various disciplines outlined to develop a disaster plan.
- 11.2 Blockading Refuse. One of the most pressing needs after a disaster and through the early stages of the recovery period is to remove blockading refuse from the streets of a municipality and the major roads of the county. The roads must be opened as soon as possible to aid transportation and recovery. In all probability certain sections will be blocked by mountains of trees, limbs, and wind blown debris.

Through this blockage of solid waste, a clear way must be cut along the roadway wide enough for truck passage, with turnouts where they can be cut without too much trouble and loss of time. The material removed from the central part of the road should be stored along side the roadway for future pick up.

This clearing work should be done under the supervision of the County Engineer or a municipal engineer if the municipal plan has been approved by the county commissioners.

A second pass by the crew preparing the debris for pick up will probably be necessary. On this pass, all solid waste should be cut to a size so that a truck crane can load them on a truck.

In order to pick up the solid waste and dispose of it as soon as possible, and due to the great quantities to be disposed of, all available trucks and crews will have to be contracted for. Extra men will have to be hired by the hour and sent out with existing work crews or made up into crews to go out with newly hired trucks and drivers.

Chapter 17-5 F.A.C. on open burning contains a provision

to permit burning "when an emergency exists which requires immediate action to protect human health and safety." This provision would provide means to reduce the large quantities of refuse which may accompany a natural disaster.

The pick up and disposal of regular garbage and trash must be made along with the material caused by the disaster. Some separation of the two will be recommended by the County Health Department and instructions issued to the regular garbage collectors, regarding emergency service. Public cooperation will be required.

- 11.3 Emergency Sites. In order to ensure short haul distances for the disposal of the disaster solid waste, the County Health Department should determine new emergency sites as close as possible to the center of the debris concentration. At these sites, burning will be allowed on a controlled basis, with the cooperation of the Florida Division of Forestry. The instructions will be issued to the County Health Department after a conference with the county Civil Defense Director and other state departments. If it is in the best interest of the public welfare, emergency burning sites should be located in public parks or open lots and burning should be supervised as required.

12.0 MODEL ORDINANCE, COLLECTION CONTRACT, INTER-GOVERNMENTAL AGREEMENT

- 12.1 Model Ordinance. Ordinance 72-14 of Brevard County, as it exists at the time of this writing, appears to best suit the intent of the Florida Resource Recovery and Management Act. It is offered here as a possible pattern for other counties to use in formulating new or updating their existing ordinances on solid waste management. If this ordinance is used, it must be modified to suit local conditions and needs.

Where differences occur between this ordinance and Department rule; Chapter 17-7, F.A.C.; the rule shall prevail.

ORDINANCE NO. 72-14

An ordinance relating to the collection and disposal of solid waste generated within both the incorporated and unincorporated areas of Brevard County; defining certain terms; providing for an exclusive method for the disposal of solid waste by all inhabitants, municipalities and governmental agencies within Brevard County; providing for the establishment of a bulk charge to municipalities for solid waste disposal; providing for a lien against all improved property within the unincorporated areas of Brevard County for the disposal of solid waste; providing for a lien against all improved property within designated service districts within the unincorporated areas of Brevard County for the collection of solid waste; designating the unincorporated areas of Brevard County a special purpose district for the generation of revenue by service charges levied against improved property to pay the cost of disposal of solid waste; providing that the collection of solid waste by authorized collectors within certain areas of Brevard County shall be mandatory; requiring a permit for the disposal, collection and transportation of solid waste without said service area; designating all areas within the areas of mandatory collection a special purpose district for the generation of revenue by service charges levied against improved property for the collection of solid waste; providing the method and conditions for the establishment of a rate or charge for said disposal lien and collection lien; providing the procedure for and terms and conditions of contracts for the collection of solid waste within the unincorporated areas of Brevard County; repealing inconsistent provisions of Chapter 59-1059, Special Acts of Florida, 1959; providing that removal of solid waste contrary to established methods shall be a misdemeanor; providing for the keeping of records; providing a procedure for the billing, collection and enforcement of disposal liens and collection liens; providing that the dumping and burying of solid waste on non-owned property shall be a misdemeanor; providing penalties; providing for an effective date.

Whereas, Chapter 67-1146, Special Acts of Florida, 1967, as amended by Chapter 70-594, Special Acts of Florida, 1970, authorized the Board of County Commissioners of Brevard County, Florida, to construct, operate and maintain a solid waste disposal system for the use and benefit of the inhabitants and municipalities of Brevard; and

Whereas, said statutory authority granted the Board of County Commissioners the power to compel the inhabitants of Brevard County, whether within or without municipalities, and all municipalities within Brevard County to use the system established by Brevard County for solid waste disposal

exclusive of any other solid waste disposal system being operated or maintained by any other governmental authorities; and

Whereas, said statutory authority granted the Board of County Commissioners the power to prescribe, fix, establish and collect fees, rentals or other charges for the use of said established solid waste disposal system and to pledge such revenues as security for the payment of bonds issued under said statutory authority for the construction of a solid waste disposal facility; and

Whereas, Section 10D-12.04 of the Rules of the Department of Health and Rehabilitative Services, Division of Health, has been superceded by Chapter 17-7 F.A.C. of the Department of Environmental Regulation, requires all municipalities to be responsible for providing an adequate, efficient and sanitary system of collecting, transporting and disposing of garbage and rubbish generated within their boundaries; and

Whereas, Section 125.01(17), Florida Statutes, as amended by Chapter 71-14, Laws of Florida, 1971, granted the Board of County Commissioners the power to establish special purpose districts for any part or all of the unincorporated areas of the county, within which may be provided garbage and trash collections and disposal from funds derived from service charges and taxes; and

Whereas, after careful and deliberate study of the report of the projects development and preliminary plans prepared by the consulting engineers for the Brevard County Solid Waste Disposal System, the Board of County Commissioners authorized the implementation of the recommended plan contained in said report and the final design by said consulting engineers; and

Whereas, the Board of County Commissioners on the 20th day of July, 1972, adopted a resolution authorizing the issuance of \$6,770,000.00 Solid Waste Disposal System Revenue Bonds to finance the construction of a solid waste disposal facility for the disposal of all solid waste in both the incorporated and unincorporated areas of Brevard County; and

Whereas, it is the purpose of this ordinance to implement the provisions of Chapter 67-1146, Special Acts of Florida, 1967, as amended by Chapter 70-594, Special Acts of Florida, 1970, and the conditions and covenants of said financing resolution dated the 20th day of July, 1972.

Now, therefore, be it ordained by the Board of County Commissioners of Brevard County, Florida, that:

Section 1. A new ordinance of the Code of Brevard

County, Florida, to be designated as Chapter 20, Article IV, Sections 20-43 through 20-68 of said Code is hereby adopted to read as follows:

ARTICLE IV

MANDATORY COLLECTION AND DISPOSAL OF SOLID WASTE WITHIN BREVARD COUNTY

Section 20-43. Definitions: For the purpose of this ordinance, the definitions contained in this section shall apply unless otherwise specifically stated:

- (a) Billing Date. The term "billing date" refers to the date established by the Board as the beginning date for the levy of a disposal or collection lien for a designated period of service.
- (b) Board. The word "Board" shall refer to the Board of County Commissioners of Brevard County, Florida.
- (c) Collection Service Charge. The term "collection service charge" refers to the service charge levied against all improved property in designated service areas in the unincorporated areas of the county to pay the cost of the collection of solid waste on improved property within said service area, the billing and collection of said solid waste, and the transportation of said solid waste to the solid waste disposal facility.
- (d) Collector. The word "collector" refers to the person required to collect and transport solid waste in a service area by the Board under the provisions of a collection agreement.
- (e) Commercial Property. The words "commercial property" shall mean any hotel, motel, rooming house, tourist court, trailer park, and any other business or establishment of any nature or kind whatsoever other than residential property.
- (f) County. The word "county" shall refer to both the incorporated and unincorporated areas of Brevard County, Florida.

- (g) Disposal Service Charge. The term "disposal service charge" refers to the service charge levied against all improved property in the unincorporated areas of Brevard County to pay the cost of the construction, operation, financing and maintenance of a solid waste facility.
- (h) Garbage. The word "garbage" shall mean every refuse accumulation of animal, fruit or vegetable matter that attends the preparation, use, cooking and dealing in, or storage of edibles, and any other matter, of any nature whatsoever, which is subject to decay, putrefaction and the generation of noxious or offensive gasses or odors, or which, during or after decay, may serve as breeding or feeding material for flies or other germ-carrying insects, or any container of the material defined herein.
- (i) Garden Trash. The words "garden trash" shall mean all accumulations of leaves, grass or shrubbery cuttings, and other refuse attending the care of lawns, shrubbery, vines and trees.
- (j) Governmental Agencies. The words "governmental agencies" shall refer to all state, federal or local agencies of government located within the county that own improved property, including but not limited to the School Board of Brevard County, all special districts with all or part of their boundaries within the county and any municipality or special district whose boundaries are not within the county but who owns improved property within the county.
- (k) Improved Property. The term "improved property" refers to all residential or commercial property that generates or is capable of generating solid waste.
- (l) Industrial Wastes. The words "industrial wastes" shall mean the waste products of canneries, slaughterhouses or packing plants, condemned food products, agricultural waste products, waste and debris from brick, concrete block, roofing shingle or tile plates, debris and wastes accumulated from land clearing, excavating, building, rebuilding, and altering of buildings, structures, roads, streets, sidewalks or parkways and other solid waste products generated from industrial processing or manufacturing.

- (m) Junk. Any tangible item such as furniture, appliances, bicycles, motor vehicles or smaller property not having a useful purpose to the owner or abandoned by the owner and not included within the definitions of garbage, garden trash, industrial wastes or rubbish.
- (n) Multiple Family Residence. The term "multiple family residence" refers to a building or structure that is designed for and capable of housing conveniently three (3) or more individuals or families in separate quarters.
- (o) Municipality. The words "municipality" or municipalities shall refer to all incorporated municipalities within the boundaries of Brevard County, Florida.
- (p) Owner. The word "owner" refers to the person or persons owning an interest in improved property in the unincorporated areas of Brevard County.
- (q) Person. The word "person" shall mean either an individual, firm, partnership, corporation, association, executor, administrator, trustee or other legal entity, whether singular or plural, masculine or feminine, as the context may require.
- (r) Project. The word "project" refers to the solid waste disposal system constructed and maintained by Brevard County.
- (s) Residential Property. The words "residential property" shall mean any structure or shelter, or any part thereof, used, or constructed for use, as a residence for one (1) or more families or individuals and includes the words "multiple family residence" as defined herein.
- (t) Rubbish. The word "rubbish" shall mean refuse accumulation of paper, excelsior, rags, or wooden or paper boxes or containers, sweepings, and all other accumulations of a nature other than garbage, which are usual to housekeeping and to the operation of stores, offices and other business places, also any bottles, cans or other containers which, due to their ability to retain water, may serve as breeding places for mosquitoes or other water-breeding insects.

- (u) Service Area. The term "service area" refers to the geographic area in the unincorporated areas of Brevard County that is designated by the Board under a collection agreement with a collector.
- (v) Solid Waste. The words "solid waste" shall be a general term that includes the specific terms "garbage", "garden trash", "junk", "rubbish" and "industrial wastes".
- (w) Solid Waste Disposal System. The phrase "solid waste disposal system" refers to the total plan of the Board for the collection, billing and disposal of solid waste within the county.
- (x) Solid Waste Facility. The words "solid waste facility" shall mean and include the buildings, land, location, and equipment constructed and maintained by the Board to dispose of solid waste within the county.

Section 20-44. Purpose: It is the purpose of this ordinance to provide that all inhabitants of the county, with certain exceptions, all governmental agencies, and all municipalities shall exclusively use the solid waste facility for the disposal of all solid waste generated within both the incorporated and unincorporated areas of Brevard County; to establish rates and charges for municipalities for the disposal of solid waste at the solid waste facility; to establish rates and charges for the collection and disposal of solid waste for the inhabitants of the unincorporated areas of the county; to provide for a service charge against improved property in the unincorporated areas of the county for the collection and disposal of solid waste according to established classifications based upon the use to which such land is devoted; to provide that such service charges for collection and disposal of solid waste shall be a lien upon such improved property; to establish the method and procedure for the levy and foreclosure of such liens for nonpayment; to provide for the collection of solid waste within the unincorporated areas of Brevard County; and to provide for the operation of the solid waste facility.

Section 20-45: Legislative Declaration: It is hereby declared that the disposal of solid waste collected within both the unincorporated and incorporated areas of Brevard County shall be exclusively at the solid waste facility constructed and maintained by the Board of County Commissioners of Brevard County and all solid waste collected by municipalities and governmental agencies within the county shall be disposed of at said solid waste facility according to procedures and methods specified in this ordinance. It is hereby further declared that the topography and water table

of Brevard County is not susceptible to accommodating effective and efficient sanitary landfills as an acceptable method for the disposal of solid waste and that the use of traditional landfill practices is a menace to the general health and a hazard to the environment. It is hereby further declared that the operation of numerous independent and separate solid waste disposal systems by various municipalities, Brevard County and other entities with varying standards of operation and control creates a serious and critical health and safety problem to all of the citizens of Brevard County and that the use of one solid waste disposal facility and system operating uniformly and with minimum ecological impact is vital and imperative to the health, safety and welfare of the people of Brevard County and other living things.

Section 20-46. Municipal Disposal Charge: The Board shall establish a bulk charge to municipalities for the disposal of solid waste collected by such municipalities within their corporate boundaries at the solid waste facility. Said bulk charge shall be established by the Board by resolution only after notice of a public hearing shall have been published at least twice in a newspaper of general circulation published in the county at least twenty (20) days prior to the public hearing. Said bulk charge plus the disposal service charge calculated under Section 20-50 of this ordinance for the unincorporated areas of the county shall be amended from time to time to produce sufficient revenue to pay the cost of the operation of the solid waste disposal facility and the debt service obligations of the outstanding bonded indebtedness, the reserve requirements and any temporary loans as provided in the financing resolutions for the project. Said bulk charge shall be uniform and equitable to all municipalities based upon the bulk amount of solid waste that is generated within each municipality and shall be comparable to the total disposal service charge in the unincorporated areas based upon the bulk amount of solid waste generated in the unincorporated areas of the county.

Section 20-47. Prima Facie Evidence of Accumulation of Waste: The fact that any residential property or any commercial property that is located within the unincorporated areas of the county is occupied, or is capable of being occupied, shall be prima facie evidence that garbage or other solid waste is being produced or accumulated upon such property. Disposal service charges and collection service charges, when applicable, shall be levied against newly constructed residential or commercial property as a lien immediately following the initial connection of permanent electric utility service or whenever the first solid waste is collected from said property by authorized collectors of the county, whichever occurs first.

Section 20-48. Disposal Service Charge and Collection

Service Charge Shall Constitute Liens Against All Improved Property in the Unincorporated Areas of the County: Except as otherwise provided in this ordinance, all owners of improved real property in the unincorporated areas of the county are hereby required to dispose of all solid waste at the solid waste facility and are hereby required to have all solid waste generated on their property collected by authorized collectors of the county. The amount of such service charge for such disposal and collection shall be the rate established from time to time under the provisions of this ordinance. All disposal service charges and collection service charges becoming due and payable on the established billing date as provided herein shall constitute, and are hereby imposed as, liens against the improved property as provided under the provisions of this ordinance on said billing date and until fully paid and discharged or barred by law, shall remain liens equal in rank and dignity with the lien of county ad valorem taxes and superior in rank and dignity to all other liens, encumbrances, titles and claims in, to or against the real property involved.

Such disposal and collection liens shall become delinquent if not fully paid within sixty (60) days after the billing date. All delinquent disposal and collection liens shall bear an initial penalty of four per cent (4%) and an additional penalty of one per cent (1%) per month on the delinquent balance that is unpaid over sixty (60) days from the applicable monthly billing date. Unpaid and delinquent disposal and collection liens, together with all penalties imposed thereon, shall remain and constitute liens for disposal and collection against the real property for a period of five (5) years from the date of recording as provided herein. If any disposal and collection lien levied against any improved property remains delinquent and unpaid for a period of six (6) months after the initial billing date, the entire amount of said disposal and collection lien levied against said improved property for said six month period shall be incorporated in a Notice of Lien with other delinquent and unpaid disposal and collection liens, showing a legal description of the real property against which the lien is claimed, its location by street and number, if available, and the name of the owner of such property as indicated on the records of the Tax Assessor of Brevard County, Florida. Said Notice of Lien shall be recorded in the public records of Brevard County, Florida.

Such recorded liens may be discharged and satisfied by payment to the county of the aggregate amounts specified in the Notice of Lien, together with interest thereon from the date of filing of the lien computed at the rate of eight per cent (8%) per annum, together with the additional sum of Five Dollars (\$5.00) for abstracting and recording costs and the amount of any delinquent and unpaid disposal and collection service charge or lien not recorded on a Notice of Lien and the full amount required to discharge and satisfy any other

recorded Notice of Lien against the real property. When any such lien has been fully paid or discharged, the county shall promptly cause evidence of the satisfaction and discharge of such lien to be provided for the sum of Five Dollars (\$5.00). Said lien shall not be assigned by the county to any person, firm, corporation or legal entity.

If any disposal and collection lien incorporated on any recorded Notice of Lien remains delinquent and unpaid by the time the Tax Collector of Brevard County is required to mail the notice of taxes under Florida Statutes, Section 197.065, a statement shall be prepared by the administrator of the Utilities Services Division of county government of the amount required to discharge the billing date prior to the date of intended mailing by the Tax Collector of Brevard County of said notice. Said statement shall be mailed by the Tax Collector to the owner of such improved property against which such recorded lien is levied along with the notice of taxes specified under said Section 197.065.

Such disposal and collection liens may be enforced at any time by the Board during the period of five (5) years from the date of recording of the Notice of Lien, for the amount of such liens, plus interest, costs and a reasonable attorney's fee, by a proceedings in a court of equity to foreclose said lien in the manner in which a mortgage lien is foreclosed under the Laws of Florida, or, in the alternative, foreclosure proceedings may be instituted and prosecuted under the provisions of Chapter 173, Florida Statutes, or the collection and enforcement of payment thereof may be accomplished by any other method authorized by law. It shall be lawful to join in any complaint for foreclosure or any such legal proceedings, any one (1) or more lots or parcels of land that is the subject of a lien or liens.

The Utility Services Division of county government is authorized and directed to execute and deliver, upon request, a written certificate certifying the amount of disposal and collection liens due upon any parcel of real property, or certifying that no such liens are due except current and non-delinquent liens, which certificates shall be binding upon the county. The Board may adopt by resolution rules and regulations prescribing uniform procedures governing the administration of the provisions of this ordinance and providing procedures for the payment of delinquent and unpaid disposal and collection liens in periodic installments.

Section 20-49. Designation of Unincorporated Areas of the County as a Special Purpose District for Solid Waste Disposal: Pursuant to the provisions of Section 125.01(1)(q), Florida Statutes, as amended by Chapter 71-14, Laws of Florida, 1971, all of the unincorporated areas of the county are hereby designated a special purpose district for the disposal of solid waste. A disposal service charge, as defined in Section 20-43 and as specified in Sections 20-48

and 20-50 of this ordinance, is hereby designated as the means to provide the funds to pay the cost of the construction, financing, maintenance and operation of the solid waste disposal facility. The property against which such disposal service charge is levied and the method and manner of calculating said disposal liens, determining the benefit, levying said disposal liens and enforcing the collecting said disposal liens shall be as provided under the provisions of this ordinance.

Section 20-50. Disposal Liens: It is hereby declared that the construction, operation and maintenance of the solid waste facility is a benefit and improvement to all improved property within the unincorporated areas of Brevard County regardless of use and occupancy. The construction, operation and maintenance of said solid waste facility directly improves and benefits such improved property by insuring a source for the disposal of solid waste being generated, or potentially and compatible with the health and safety of all citizens in the county after a consideration of the nature of the geography and environment of the county.

The Board shall establish a schedule of rates and classifications for the disposal service charge for residential and commercial improved property in the unincorporated areas of the county. Said schedule of rates and classifications shall be adopted by resolution only after notice of a public hearing shall have been published at least twice in a newspaper of general circulation published in the county at least twenty (20) days prior to the public hearing. Said disposal service charge plus the bulk municipal disposal charge specified under Section 20-46 of this ordinance shall be amended from time to time to produce sufficient revenue to pay the cost of the operation of the solid waste disposal facility and the debt service obligations of the outstanding bonded indebtedness, the reserve requirements, and any temporary loans as provided in the financing resolutions for the project. Said resolutions adopting a schedule of rates and classifications shall also establish the billing period for the disposal service charge and the method of payment. Said disposal service charge shall be due and payable on the billing date for the service to be provided during the established billing period and shall constitute a lien against such improved property as of the said billing date.

Section 20-51. Contracts with Authorized Collectors: The Board may enter into contracts with any person, firm or corporation to provide for the collection of solid waste generated within specified service areas in the unincorporated areas of the county. Said contracts shall contain a description of the solid waste collection service area; the name of the person granted the right to collect the solid waste generated within the service area; the length of the

agreement; the consideration to be paid for such collection agreement, if any, and the method of payment; the service to be furnished by the collector; the amount and method of payment to the collector for his performance under the collection agreement; the performance bond and the conditions thereof, if one is deemed necessary, to be furnished by the collector; and such reasonable rules and regulations governing the performance by the collectors as are deemed necessary to implement the provisions of this ordinance and to effectively operate and maintain the solid waste disposal facility. Such agreement may be exclusive or non-exclusive and the term shall not exceed five (5) years.

Such collection agreements shall be entered into by the Board only after the holding of a public hearing to consider the propriety of entering into said agreements. At such public hearing the Board shall consider the financial responsibility and competency and capability of performance of the collector; the proposed cost of collection within the service area; and the amount of consideration, if any, proposed to be paid to the county by any person desirous of entering into a collection agreement with the county. Notice of the time and place of such public hearing shall be published one (1) time in a paper of general circulation in the county at least twenty (20) days prior to said hearing. Provided, however, the Board shall have the right, in its sole discretion, to enter into such collection agreements with those persons holding an existing collection franchise with the county granted under the provisions of Chapter 59-1059, Special Acts of Florida, 1959, for a term equal to the unexpired term of such collection franchise without the necessity of a public hearing.

Section 20-52. Conditional Repeal of Chapter 59-1059, Special Acts of Florida, 1959: Pursuant to the provisions of Article VIII Section 6(d) of the Constitution of the State of Florida, 1968, the provisions of Chapter 59-1059 Special Acts of Florida, 1959, that are inconsistent or in conflict with the provisions of Section 20-51 of this ordinance are hereby repealed.

Section 20-53. Designation of Service Area: The Board shall designate from time to time by resolution service areas within the unincorporated areas of Brevard County within which it shall be mandatory that the owners of all improved real property in said service areas used solely and exclusively the system of collection established by the county for the removal of all solid waste generated on such improved property. No owner of such improved property in any designated service area may remove, or cause to be removed, any solid waste generated on his property except exclusively according to the system of solid waste collection established by the county under the provisions of this ordinance. It shall be the duty of each owner of improved property in any designated service area to insure that each

manager, occupant, lessee of, or other person responsible for any residential or commercial property in any service area, uses solely and exclusively the system of collection established by the county for the removal of all solid waste on such improved property. Removal of solid waste generated on any improved property within any designated service area by means other than solely and exclusively through the system of solid waste collection established by the county under the terms of this ordinance shall not relieve such improved property from the liability of the collection service charge and lien provided under the provisions of this ordinance.

Section 20-54. Collection Liens: The Board shall establish a schedule of rates and classifications for the collection service charge for residential and commercial improved property within the designated service area. Said schedule of rates and classifications shall be adopted by resolution only after notice of a public hearing shall have been published at least twice in a newspaper of general circulation published in the county at least twenty (20) days prior to the public hearing. Said collection service charge shall produce sufficient revenue to pay the cost of the performance by authorized collectors under their collection contracts with the Board and the cost of the administration, billing, and enforcement by the Board of collection and disposal liens.

Said resolution adopting a schedule of rates and classifications for said collection service charge may also establish the following:

- (1) The billing period for the collection lien and the method of payment.
- (2) The classifications based upon the use to which improved property is devoted for the calculation of a uniform collection service charge for collection of solid waste.
- (3) Any period of vacancy or non-use that would entitle any improved property to an abatement or reduction of the collection service charge and lien.
- (4) Any duties or obligations of the owner of improved property to entitle such property to an abatement or reduction of the collection service charge and lien because of vacancy or non-use.
- (5) Any exceptions based on unique financial hardship or other unique circumstances.
- (6) Any assumption of occupancy or use for a

multiple family residence within an established classification for the purpose of calculating a collection service charge and lien.

- (7) The manner and method of determining when property becomes improved property for the purpose of calculating a collection service charge and lien for such property.
- (8) Any other factor relating to establishing a uniform and equitable collection service charge and lien for the collection of solid waste.

Said collection service charge shall be due and payable on the billing date for which the service is to be provided during the established billing period and shall constitute a lien against such improved property as of said billing date.

Section 20-55. Penalty for Removal of Solid Waste Contrary to Established Collection System: Any person, firm or corporation who removes solid waste from any improved property within any designated service area without obtaining a collection permit under the provisions of Section 20-56 of this ordinance shall be deemed guilty of a misdemeanor and shall be punished by a fine not exceeding five hundred dollars (\$500.00) or by imprisonment in the county jail for not more than sixty (60) days, or by both such fine and imprisonment.

Section 20-56. Permits for Private Collection Within Designated Service Area: The Board shall have the right to adopt reasonable rules and regulations for the issuance of permits to an owner of improved property within any service area designated in Section 20-53 of this ordinance for the removal and transportation to the solid waste facility of all solid waste generated solely on the property owned by such person under the following circumstances:

- (1) The amount of the collection service charge established under Section 20-54 of this ordinance creates a unique economic hardship to the owner of the improved property based upon the amount of solid waste generated by the use to which such improved property is devoted.
- (2) The nature and amount of solid waste generated on such improved property is of a unique type and character from that normally collected by the authorized collector.
- (3) The vast majority of solid waste generated on such improved property is industrial waste, rubbish or junk.

Said collection permit shall only be issued to those owners of improved property within the above circumstances and shall be subject to reasonable rules and regulations setting the standards under which such owner is deemed to be within the scope of such circumstances. Each collection permit issued under the provisions of this section shall be subject to the following conditions:

- (1) The owner shall remove such solid waste at such sufficient intervals based upon the amount of solid waste generated as specified by the Brevard County Health Department to insure the prevention of a health hazard or nuisance through the accumulation of solid waste.
- (2) All solid waste shall be collected and transported in a manner approved by the Brevard County Health Department to insure that solid waste does not accumulate upon such improved property or fall or be blown from any proposed transporting vehicles.

Upon the issuance of such a collection permit, the owner of such improved property shall be exempt from the mandatory use of an authorized collector for the transport and collection of solid waste generated solely on the property owned by the permit holder. Nothing contained in this section shall be construed to exempt such property from the disposal service charge and lien levied in Section 20-50 of this ordinance and all improved property shall be liable for said disposal service charge and lien regardless of the issuance of such permit.

Section 20-57. Designation of Unincorporated Areas of the County as a Special Purpose District for Solid Waste Collection: Pursuant to the provisions of Section 125.01 (1)(q), Florida Statutes, as amended by Chapter 71-14, Laws of Florida, 1971, all of the unincorporated areas of the county included within service areas designated under the provisions of Section 20-53 of this ordinance are hereby designated a special purpose district for the collection of solid waste. A collection service charge, as defined in Section 20-43 and as specified in Sections 20-46 and 20-54 of this ordinance, is hereby designated as the means to provide the funds to pay the cost of the collection of solid waste within such special purpose district. The property against which such collection service charge is levied and the method and manner of calculating said collection lien, levying said collection liens and enforcing and collecting said collection liens shall be as provided under the provisions of this ordinance.

Section 20-58. Collection of Solid Waste on Property Without Service Area: Any owner of residential or commercial

improved property not included within a designated service area under Section 20-53 of this ordinance may dispose of solid waste on said improved property or collect and transport solid waste generated solely on said improved property to the solid waste facility upon obtaining a permit from the county. Said owner of improved property shall have the option of contracting with any authorized collector for the collection and transportation of such solid waste to the solid waste facility, in which case a permit under this section shall not be required.

In the event said owner of improved property does not elect to contract with an authorized collector for the collection and transportation of solid waste generated on his property, the permit authorized under this section shall be issued only upon the owner satisfying the Brevard County Health Department that his plan of on-site disposal or collection and transportation will not constitute a health hazard or public or private nuisance based upon the following considerations:

- (1) The plan of on-site disposal must have sufficient safeguards, based on the size and nature of the property, to insure that existing water sources and water tables are not susceptible to contamination; any proposed burning must be in complete compliance with existing state and local requirements for preventing air pollution; there shall be sufficient distance between the proposed area of on-site disposal and contiguous property not under identical ownership to insure that such disposal will not adversely affect such contiguous property or create a health hazard or public or private nuisance; and all on-site disposal must be performed at the times and in the method required according to recognized landfill procedures.
- (2) The owner shall remove such solid waste at such sufficient intervals based upon the amount of solid waste generated as specified by the Brevard County Health Department to insure the prevention of a health hazard or public or private nuisance through the accumulation of solid waste.
- (3) All solid waste shall be collected and transported in a manner approved by the Brevard County Health Department to insure that solid waste does not accumulate upon such improved property or fall or be blown from any proposed transporting vehicles. The Board shall establish from time to time uniform regulations and conditions on the issuance of such permits including the term of such permits.

In the event said owner of improved property elects to contract with an authorized collector for the collection and transportation of solid waste generated on his property, the rate or fee charged for such service shall be approved by the Board after taking into consideration the following factors: The rate of collection service charge established for improved property within a designated service area for similar property as provided in Section 20-54 of this ordinance; the distance to such improved property from the established collection route of the authorized collector; the frequency of the collection by the authorized collector; the average monthly amount of solid waste generated on such property; and the degree of additional costs to be authorized collector in collecting said solid waste.

Nothing contained in this section shall be construed to exempt such property from the disposal service charge and lien levied under Section 20-50 of this ordinance and all improved property shall be liable for said disposal service charge and lien regardless of the issuance of such permit.

Section 20-59. Exclusiveness of Collection: It shall be unlawful for any person to collect or transport solid waste upon or along public streets, roads or alleys of the county unless said person, firm or corporation holds a collection contract with the Board as provided in Section 20-51 of this ordinance. Provided, however, that this provision shall not apply to any person authorized by a municipality to transport solid waste collected within such municipality to the solid waste facility; to any governmental agency collecting and transporting solid waste pursuant to a permit authorized under Section 20-60 of this ordinance; or to any person collecting and transporting solid waste generated solely on improved property owned by such person in compliance with the terms and conditions of a permit issued under the provisions of Sections 20-56 or 20-58 of this ordinance. Any person who violates the provisions of this section shall be deemed guilty of a misdemeanor and shall be punished by a fine not exceeding five hundred dollars (\$500.00) or by imprisonment in the county jail for not more than sixty (60) days, or by both such fine and imprisonment.

Section 20-60. Disposal and Collection Charge to Governmental Agencies and County Agencies: All governmental agencies owning improved property within the county whose solid waste is not collected by a municipality shall pay the disposal service charge established under the provisions of Section 20-50 of this ordinance under the applicable classification specified in the disposal service charge resolution. Nothing contained herein is to be construed to relieve the improved property used or occupied by, or leased or rented to, a governmental agency, but owned by a private person, from the liability for the disposal lien provided for under

Sections 20-48 and 20-50 of this ordinance.

All governmental agencies owning improved property within the unincorporated areas of Brevard County, or using, occupying renting or leasing improved property within the unincorporated areas of the county, are hereby required to comply with the provisions of Sections 20-53, 20-54, 20-55, and 20-56 or Section 20-58, whichever is applicable. In the event said improved property is located within a service area and is used and occupied by, or rented or leased to, a governmental agency but is owned by a private person, nothing contained herein shall be construed to relieve such improved property from the liability for the collection lien provided under the provisions of Sections 20-48, 20-54 and 20-57 of this ordinance unless such person qualifies for and obtains a collection permit as provided under the provisions of Section 20-56 of this ordinance.

All county agencies are hereby required to use the solid waste facility for the disposal of all solid waste and each such county agency or county department shall pay the disposal service charge established under the provisions of Section 20-50 of this ordinance under the applicable classification specified in the disposal service charge resolution.

Section 20-61. Exception on Fill Material: The provisions of this ordinance do not apply to a person transporting or dumping, with the permission of the owner of the property, sand, dirt, broken brick, blocks, broken pavement or other material suitable for use as fill material for the sole purpose of raising the elevation of land.

Section 20-62. Total Pick Up Within Designated Service Areas: All solid waste generated in the designated service areas of the county shall be collected and transported by the authorized collectors unless a permit has been issued to the owner of such

Section 20-63. Maintenance of Records: The Utilities Services Division of county government shall maintain complete and accurate records of the following:

- (1) The costs and expenditures for providing solid waste collection in the unincorporated areas of the county.
- (2) The costs and expenditures for operating and maintaining the solid waste disposal facility.
- (3) The costs and expenditures incurred in maintaining a system for the billing, collection and enforcement of the disposal service charge and liens and collection service charge and liens levied by the Board.

- (4) The total amount of bulk solid waste delivered by each municipality to the solid waste facility.
- (5) The total amount of bulk solid waste collected in each service area of the county by the authorized collectors.
- (6) The names and addresses of all holders of permits issued under the provisions of Sections 20-56 and 20-58 of this ordinance.
- (7) The amount of revenue received from the levying of a disposal service charge in the county and from each municipality as a bulk disposal charge.
- (8) Any other record required to be kept by the Board from time to time.

Section 20-64. Billing and Collection in the Unincorporated Areas of Brevard County: The Utilities Services Division of Brevard County shall maintain records and accounts and be solely responsible for the billing, collection and enforcement of the disposal service charge and liens and collection service charge and liens levied by the Board in the unincorporated area of the county. The Board shall adopt, by resolution from time to time, necessary policies, procedures and standards to implement an effective billing and enforcement program for the disposal and collection service charges provided under this ordinance.

Section 20-65. Dumping or Burying Solid Waste Without Proper Authorization: It shall be unlawful for any person to dump, leave or bury any solid waste on public or private property without the written consent of the owner of such property. Any person who violates the provisions of this section shall be deemed guilty of a misdemeanor and shall be punished by a fine not exceeding five hundred dollars (\$500.00) or by imprisonment in the county jail for not more than sixty (60) days, or by both such fine and imprisonment.

Section 20-66. Collection Services Within Incorporated Areas; Location of Receptacles: Each residential or commercial improved property located in a designated service area within the county shall have a sufficient number of garbage cans, plastic bags, or other approved waste containers to accommodate the removal of all solid waste by the authorized collectors. The Board shall adopt by resolution from time to time reasonable and uniform rules and regulations on the times and conditions for the collection of solid waste within the designated service areas of the county.

Solid waste receptacles shall be placed at ground level, on the premises of the improved property from which the solid waste is generated, and shall not be kept upon county

or publicly owned property or rights-of-way or upon property not owned by the identical person owning the improved property from which the solid waste was generated.

Before building permits may be issued for the construction of shopping centers, multiple family residences, and supermarkets in the unincorporated areas of the county, plans for storage of solid waste must be approved by the director of the Utilities Services Division of county government as to location, accessibility and adequacy and for compliance with all applicable laws, ordinances and state rules and regulations.

Section 20-67. Effective Date; Schedule: It is hereby acknowledged that the Board has authorized its consulting engineer for the Brevard County Solid Waste Disposal System to complete the final design of such system in accordance with the recommendations contained in the project development and preliminary plans prepared by said consulting engineers; that the start of construction of the project is to begin immediately upon the completion of said final design; that the Board has authorized the issuance of \$6,770,000.00 Solid Waste Disposal System Revenue Bonds to finance the construction of said project; and that the resolution authorizing the issuance of said bonds contains a covenant by the Board that no later than one (1) year from the date of delivery of the obligations, a schedule of rates and charges shall be effective and implemented which provide revenues necessary to comply with and to conform to the rate covenant specified in said financing resolution. It is hereby further acknowledged that the Board is currently operating landfills within Brevard County on an interim basis until the completion and start of operation of the proposed solid waste disposal system.

This ordinance shall become effective immediately upon passage and filing with the Secretary of State as provided by law. The Board shall implement all or any of the provisions of this ordinance by the adoption of a resolution or resolutions of implementation fixing a date certain for implementation. Such resolution or resolutions of implementation may be changed at any time subsequent to the effective date of this ordinance but shall be fully implemented no later than one (1) year from the sale of the \$6,770,000.00 Solid Waste Disposal System Revenue Bonds. In the event the Board implements the terms and provisions of this ordinance prior to one (1) year from the sale of the \$6,770,000.00 Solid Waste Disposal System Revenue Bonds, the term "solid waste facility" as used in this ordinance shall be deemed to include all landfills operated and maintained by the county.

Any resolution of implementation shall be adopted only after a public hearing, the notice of which shall be published

in a newspaper of general circulation published in the county at least fifteen (15) days prior to said hearing, excluding Sundays and legal holidays.

Section 20-68. Penalties: Any person, firm or corporation violating any provision of this ordinance shall be deemed guilty of a misdemeanor, and upon conviction shall be punished by a fine not to exceed five hundred dollars (\$500.00) or by imprisonment in the county jail not to exceed sixty (60) days or by both such fine and imprisonment.

Section 2. If any section, subsection, sentence, clause, phrase or portion of this ordinance is for any reason held invalid or unconstitutional by any court of competent jurisdiction, such portion shall be deemed a separate, distinct and independent provision and such holding shall not affect the validity of the remaining portion of this ordinance.

DONE AND ADOPTED in regular session this _____ day of _____, 19__.

ATTEST:

BOARD OF COUNTY COMMISSIONERS
OF BREVARD COUNTY, FLORIDA

By _____

12.2 Model for Contract Collection. Solid Waste collection service is usually provided by one of four forms:

- (a) Public collection under a government department.
- (b) Private firms with a contract from a government to collect in a given area, using contractor owned equipment. Contract conditions specify the operating criteria and a fixed fee paid by the local government for the total service.
- (c) Private firms in open competition, with little or no governmental regulation. In this system the private collector makes his own contract with the customer. This system is generally very wasteful, does not provide uniform service and is to be discouraged.
- (d) Private firms operating under exclusive franchises, with each licensed to operate solely in a given area. The franchise specifies the operating criteria and fees for service are usually collected by the franchisee.

The following model contract is offered as a possible pattern for use in an arrangement in the foregoing (b) and (d) situations, with modifications and additions to the contract to meet local conditions and needs.

12.2.1 MODEL CONTRACT FOR THE COLLECTION AND DISPOSAL OF SOLID WASTE

This Agreement, made and entered into this _____ day of _____, 19____, between the City of _____ a municipal corporation, duly organized and existing under _____ and by virtue of the laws of the State of Florida, hereinafter sometimes referred to as "City", and _____ a company doing business under the firm name of _____, hereinafter sometimes referred to as "Collector".

WITNESSETH

WHEREAS, after a public hearing and receipt of a proper application to obtain a contract, a regular Council meeting was held at _____ p.m. on the _____ day of _____, 19____, in the Council Chambers, City of _____, in which the City does hereby grant a contract to _____ upon the terms and conditions hereinafter specified.

NOW, THEREFORE, IT IS HEREBY MUTUALLY AGREED BETWEEN THE PARTIES HERETO AS FOLLOWS:

TERM. This contract for the collection and disposal of solid waste within the City of _____ shall be for the term of _____ () years from and beginning with the _____ day of _____, 19____, with the option to renew after expiration, said notice of desire to renew this agreement shall be furnished in writing by the Collector at least ninety (90) days prior to the end of the term of this agreement.

SCOPE. This exclusive contract shall be applicable to the following area within the corporate limits of the City of _____, _____ County, Florida, bounded as follows:

On the North _____
On the East _____
On the South _____
On the West _____

Also designated as District Number _____. The City also hereby gives the Collector the full power and authority to collect solid waste and to do any other necessary work incidental to the business of solid waste collection and disposal within the above described boundaries of the City.

CONTRACT FEE. The contracting parties hereby agree that in return for the City awarding the solid waste contract to the Collector, the City will return to the Collector _____ percent of the gross receipts each month.

Note: Percentages vary from 1 percent to 15 percent. In some contracts the percent varies from year to year.

DEFINITIONS OF SOLID WASTE.

- (a) "Solid Waste" means garbage, rubbish, refuse, and other discarded solid or semisolid materials resulting from domestic, industrial, commercial, agricultural, and governmental operations, but does not include solids or dissolved material in domestic sewage or other significant pollutants in water resources such as silt, dissolved or suspended solids in industrial waste water effluents, dissolved materials in irrigation return flows, or other common water pollutants.
- (b) "Garbage" means waste resulting from the preparation, cooking and serving of food; market waste and waste from produce, including containers or packaging originally used for foodstuffs.
- (c) "Rubbish" means solid wastes, excluding food waste and ashes, taken from residences, commercial establishments, and institutions.
- (d) "Bundle" means a package containing rubbish only, weighing not over fifty (50) pounds and not exceeding four (4) feet in its longest dimension, securely tied with cord or rope of sufficient strength to permit lifting and carrying of the full weight thereof without spillage or leakage and placed for collection immediately adjacent to a standard container.

STANDARD REFUSE CONTAINERS. Plastic or galvanized metal containers, water-tight, with tight-fitting covers having a capacity of not more than thirty (30) gallons or less than ten (10) gallons, with cover handle and side bails, or as otherwise approved by the City. Approved plastic or paper bags, of a type, size and material designed for refuse disposal may also be used.

CUSTOMER. The term "Customer" shall mean person or persons, firm, corporation or association who shall place garbage or rubbish for pickup and disposal by the Collector.

LIABILITY INSURANCE - BOND - WORKMEN'S COMPENSATION.

COLLECTOR. Collector shall carry public liability insurance to the extent of _____ dollars (\$ _____) for the death of or injury to more than one person, and property damage insurance to the extent of _____ dollars (\$ _____) upon each truck or other vehicle used by him in carrying out the work called for in this contract - such insurance expressly to cover both the

City and the Collector. A certificate showing that the Collector has in force and effect the aforesaid insurance covering both the Collector and said City shall be filed with the Clerk of the City of _____ within ten (10) days from the execution of this contract, and yearly thereafter at least thirty (30) days prior to the date of the expiration of said Policies of Insurance for each year of said contract. The aforesaid insurance shall be written by companies authorized to do business in Florida, and also shall contain an endorsement obligating the insurance company to furnish the City ten (10) days notice in advance of the cancellation of the insurance.

The Collector shall post with the City Clerk a performance bond in the amount of _____ dollars (\$_____) payable to the City of _____ to insure adequate service required to fulfill the terms and conditions of this contract.

Note: It is suggested that the amount of the bond be determined by the number of customers served by the Collector. The normal amount varies between \$10,000 and \$100,000. However, increased coverage may be desirable depending on the scope of the operation.

The Collector shall carry Workmen's Compensation Insurance on his employees and show proof of insurance and payment of premium thereon to the City Clerk, as requested.

COLLECTION OPERATIONS:

The Collector shall make a minimum of at least two (2) pickups per week of garbage and at least one (1) pickup per week of rubbish from all residences and commercial and institutional establishments who subscribe with the City within the contract area. (Two combination garbage and rubbish pickups per week would be acceptable - depending on local practices).

Collections shall be made between the hours of _____ a.m. and _____ p.m. in residential districts and shall be made for commercial customers between the hours of _____ p.m. and _____ a.m. subject to such reasonable modification of collection periods as the City Council may direct.

Collector shall not litter premises in process of making collection nor shall he allow any refuse to blow or fall from any vehicle used for collections and shall replace lids or covers on containers immediately after emptying.

Collector shall supply the City with current maps of collection and disposal routes and schedules of collection. He also shall supply all customers with compliant procedures, regulations and days of collection.

Collector shall provide special haul service to all customers within the contract area for bulky items.

Collector shall maintain garaging and maintenance facilities for all equipment in a condition and at a location acceptable to the City insofar as zoning, traffic, truck parking and nuisance considerations are concerned, and shall maintain all trucks in a clean and sanitary condition. Each truck shall be well painted at least annually, and shall have clearly visible insignia designating the name of the contracting firm.

All refuse, upon being removed from the premises where produced or accumulated, shall become and be the property of the Collector. Title to the waste shall be retained by the Collector only for the period the waste is in transit to a resource recovery facility whereupon, the waste becomes the property of the _____ municipality (or county).

Collections will not be made on holidays officially designated by the City.

The collector shall not be responsible for the collecting of discarded building material, brick, dirt, rock, plaster, lumber, metal or other like material originating from property preliminary to, during or subsequent to the construction or demolition of any building, alteration or additions to existing buildings of any type. The owner of the property or the Contractor shall remove or cause such material to be removed to an approved dumping site. The contract holder shall not be responsible for collecting industrial waste from factories, warehouses or abattoirs, nor any establishment classified as, or engaged in industrial work; including such items as waste grease or oils from service stations or manufacturing plants, nor any toxic or other hazardous waste. However, the contract holder may negotiate separate and individual contracts with such companies.

In the event of any emergency condition not subject to control by the Collector, the service may be reduced in accordance with such emergency conditions as approved by the City. Any unusual occurrence not subject to the control of the Collector shall immediately be reported to the City.

DISPOSAL OPERATIONS.

Collector may undertake organized salvage operations for the recycling of usable materials, upon obtaining approval of the local authority. Scavenging is prohibited.

Disposal of solid waste shall be in a manner and place approved by the Public Health Division of the City. Until further notice, the Collector shall dispose of all

refuse at the _____ sanitary landfill located at _____. If the disposal site is owned and operated by the Collector, it shall be operated in accordance with Florida Department of Environmental Regulation rules.

RATES.

Residential. The City shall charge \$_____ per month for a single family residence, for two (2) pickups per week with the collections at the curb side. Said pickups will be limited to the equivalent of not more than two (2) thirty (30) gallon standard garbage containers per family unit, per pickup. Additionally, this charge is to include domestic rubbish pickups of one (1) pickup weekly at the curb (or two combination garbage and trash pickups per week). In providing this trash service, the Collector shall not be required to pickup in excess of one (1) cubic yard per pickup.

Multiple Family Residence. As used in this Agreement, the term multiple family residence includes any building or structure designed and capable of housing conveniently three (3) or more individuals or families in separate quarters.

The Collector shall collect garbage from multiple residences at least twice each week. Said pickup shall be limited to one thirty (30) gallon container per unit. In addition, Collector shall provide one rubbish pickup per week of not in excess of ten (10) cubic feet of rubbish for each multiple unit.

For such service, City shall charge and collect the following fees:

- (a) The sum of \$_____ per month per unit on all multiple family residences containing not less than three nor more than eight units without regard to whether such units are occupied or not.
- (b) The sum of \$_____ per month per unit on all apartment buildings containing nine or more units, without regard to whether such units are occupied or not.

The owner, operator, manager or any other person, firm or corporation responsible for collecting rentals on such apartment building shall be responsible for the payment of fees.

Commercial. The City shall charge a fee of \$_____ per cubic yard for all refuse collected from commercial and business establishments. The number of containers and the

frequency of pickups per week from commercial establishments will be by mutual agreement between the City, Collector and the customer. At no time shall there be such a delay in removing refuse as to cause a health hazard or odor nuisance. The Collector shall make available to all commercial establishments generating large quantities of solid waste a container system for their refuse. Charges shall be in accordance with the following schedule:

TIMES COLLECTOR PER WEEK (MONTHLY CHARGES)

FIRST CONTAINER SIZE	1	2	3	4	5	6	7
2 cu. yd.	_____	_____	_____	_____	_____	_____	_____
3 cu. yd.	_____	_____	_____	_____	_____	_____	_____
4 cu. yd.	_____	_____	_____	_____	_____	_____	_____
6 cu. yd.	_____	_____	_____	_____	_____	_____	_____
8 cu. yd.	_____	_____	_____	_____	_____	_____	_____

Additional 2, 3, or 4 cubic yard containers, \$_____ per yard, per month. Additional 6 or 8 cubic yard containers \$_____ per month each. Castered containers \$_____ per month additional. Steam cleaning of containers \$_____. Seasonal or temporary containers - above rates plus \$_____ per month.

Special Rubbish Pickup Service. Requests for pickup of large items such as furniture, trees, sod, lumber and other items not defined in this Agreement as "Garbage" or "Rubbish" shall be considered as requests for special pickup services. Such special services shall not be covered by the fees and charges set out in this contract, but shall be agreed upon by the person requesting such service and the Collector.

The Collector may petition the City for rate adjustment on the basis of the cost of living index established by the U.S. Department of Labor. Such petitions shall be made at least 60 days prior to the anniversary date of this contract and where approved by the City shall be effective on the anniversary date.

BILLING. City shall bill all occupants or owners monthly.

COLLECTOR'S PERSONNEL.

The City may, at its option, request employment data and may request the right of prior approval of employment of any person by Collector whose services will enter into performance of this contract.

Employees driving Collector's vehicles shall at all times possess and carry a valid commercial vehicle operator's license.

Collector's employees shall be required to wear clean clothing of uniform type and color as approved by the City.

The City may request the dismissal of any employee of the Collector who violates any provision hereof, or who is wanton, negligent or discourteous in the performance of his duties.

ADMINISTRATION.

The administration and enforcement of this contract shall be the joint responsibility of the City of _____ and the Collector. It shall be the responsibility of the Collector to see that refuse service customers are provided at all times with complete information about the service.

The City Council shall recommend for adoption by the Council, in resolution form, any rules and regulations required to enforce or carry out the terms and conditions of this contract.

The City shall establish a position, and appoint a special officer whose duties shall include full-time supervision and inspection of Collector's operation to assure strict compliance with all provisions hereof and any rules and regulations adopted pursuant hereto.

The Collector's equipment shall be inspected at a point designated by the Special Officer during _____ and _____ each year of this contract and shall certify and issue a permit indicating that the Collector's equipment conforms to the regulations of the Motor Vehicle Code, the Florida Department of Environmental Regulation and Ordinances of the City of _____.

The Special Officer shall enforce the health and fire ordinances of the City of _____ and all terms and conditions of this contract.

The City intends to use diligence in enacting and enforcing regulations pertaining to the obligations of owners and occupants of premises as follows:

- (a) It shall be unlawful for any person other than this Collector or its agents or employees to collect refuse or to interfere in any manner with any receptacle containing refuse, or the contents of any refuse containers, or to remove any such receptacles from the place where same are placed by the owner or person lawfully in control thereof, or to remove the contents of such receptacles.

- (b) A red tag will be placed on the containers at the premises where fees are not paid.

MISCELLANEOUS.

Provisions of this contract shall be interpreted to attain the objective that all reasonable quantities and types of refuse placed for collection are collected.

Collector shall not enter into any sub-contracts, leases, agreements or assignment of or pertaining to this collection and disposal contract, or any interest or right herein, either voluntarily or by operations of law, without prior written approval of the City of _____.

It is agreed that in the event Contractor shall be adjudged bankrupt, either by voluntary or involuntary proceedings, then this contract shall immediately terminate. In no event shall this contract be, or be treated as an asset of Collector after adjudication of bankruptcy. If Collector shall be proven insolvent, or fail in business, then this contract may be terminated at the option of the City, in which event, the City shall have the right to immediately take possession, lease or purchase Collector's operating equipment and records.

All terms and conditions of the contract are considered material and failure to perform any of said conditions on the part of the Collector shall be considered a breach of said contract. Should Collector fail to perform any of said terms or conditions, the City shall have the right to terminate the contract, only after ten (10) days notice in writing to the Collector of the violation of the contract and the failure of the Collector to remedy the violation within said time.

In the event of termination of the contract for breach or default by the Collector as above specified, the City shall have the right to forthwith take possession of all trucks and other equipment of Collector for the purpose of collecting, hauling and disposing of refuse which Collector has agreed to do. The City shall have the right to retain possession of and operate all said trucks and equipment until other suitable trucks and equipment can be purchased or otherwise acquired by the City for such purpose, for a period not to exceed six (6) months. The City shall pay to the Collector an equitable monthly rental fee for each piece of the Collector's equipment in the City's possession. The City shall in case of any such termination, have the right of purchase of Collector's equipment and facilities at the depreciated fair market value thereof should it elect to purchase. The City shall make an equitable rebate to the Collector for services rendered prior to termination, if any be due.

AUDIT.

The Collector's books shall be open to inspection or audit at any time at the City's request and expense. A complete yearly audit shall be provided by the Collector and shall be accomplished between the first day of _____ and the fifteenth day of _____ and be paid for by the Collector.

IN WITNESS WHEREOF, the Collector has caused these presents to be signed by its proper officers and its seal to be hereto affixed and the City has caused these presents to be signed by its Mayor and Councilmen and attested by its clerk and its corporate seal to be hereto affixed, all as of the day and year first above written.

AS TO THE COLLECTOR

(Corporate Seal)

President of _____
Disposal Service, Inc.

Attest:

Secretary

AS TO THE CITY

Mayor

(Municipal Seal)

Councilman

Councilman

Councilman

Attest:

City Clerk

12.3 INTERLOCAL AGREEMENT

The following agreement is offered as a guide to the development of similar documents and should be tailored to meet local conditions. The legal mechanism to establish interlocal agreements is given in Chapter 163 Florida Statutes.

INTERLOCAL AGREEMENT

THIS INTERLOCAL AGREEMENT, made and entered into this 25th day of April, A.D. 1972, by and between THE CITY OF GAINESVILLE, a municipal corporation (hereinafter called City), and ALACHUA COUNTY, a political subdivision of the State of Florida (hereinafter called County):

W I T N E S S E T H:

WHEREAS, the City and County are authorized by Florida Statute 163.01 to enter into interlocal agreements to cooperatively utilize the most efficient use of their powers on a basis of mutual advantage and to provide services and facilities that will accord best with geographic, economic, and other factors influencing the needs and development of the total community; and

WHEREAS, the problem of disposing of solid waste is one which local governments must face; and

WHEREAS, in order to deal with this problem, the City and County together with the University of Florida and some of the other municipalities in Alachua County have created on a voluntary basis a Board made up of one (1) person designated by each of the participants which is known as the WASTE MANAGEMENT ADMINISTERING BOARD, all pursuant to recommendations approved by the City August 30, 1971, and by the County August 31, 1971, a copy of which is attached and hereby made a part hereof; and

WHEREAS, the City and County, pursuant to recommendations of the WASTE MANAGEMENT ADMINISTERING BOARD, have decided to use a sanitary landfill as the means of handling and disposing of solid waste, but to do so requires a significant investment amounting to an estimated cost of THREE HUNDRED SEVENTY-ONE THOUSAND FIVE HUNDRED SEVENTY AND NO/100 DOLLARS (\$371,570.00) for land, facilities and equipment, which must be amortized over a period of time during which such landfill site can be expected to be used for this purpose; and

WHEREAS, it seems most appropriate that the County acquire the land, facilities and equipment and own land operate same for the benefit of the City and County as well as the University of Florida if it decides to participate in this project with a corresponding commitment on the part of the City to use said landfill and pay the reasonable charges for such use as shall be from time to time determined;

NOW THEREFORE, for and in consideration of the mutual benefits to flow each to the other and in consideration of the mutual covenants, promises and representations herein, the parties hereto agree as follows:

1. Purpose of Agreement.

The purpose of this Agreement is to provide for a sanitary landfill and the operation thereof with joint participation as hereinafter set forth and to state the terms and conditions through which cooperative funding will be provided and an understanding as to the manner in which the project will be undertaken and operated.

2. Acquisition and Operation.

The County agrees to initially finance and acquire the physical facilities and equipment that will be required to operate a landfill on a sanitary basis at an anticipated cost of THREE HUNDRED SEVENTY-ONE THOUSAND FIVE HUNDRED SEVENTY AND NO/100 DOLLARS (\$371,570.00). The County shall be the legal entity responsible for the operation, development, control and management of said landfill during the term hereof. The County shall hold the City harmless from any claim or demand of any kind or nature, in any way connected with or growing out of the operation of said landfill including the defense against any such claim or demand, and as long as the County is not a self-insurer, shall maintain adequate liability insurance coverage to meet this obligation including naming the City as an insured party in such insurance policy. The County agrees to operate a landfill at such site throughout the anticipated useful life of this property which is estimated to be eight (8) years under normal anticipated usage as now foreseen.

3. Location and Useful Life.

The location of said landfill will be on a one-hundred-twenty- (120) acre site in the vicinity of Fairbanks, Florida. It is estimated that the useful life of said sanitary landfill will be a period of at least eight (8) years.

4. Repayments to County

During the anticipated useful life of the landfill facility, the financial support for the use thereof shall be by user's fees which shall be at such a rate as to reimburse the County for its costs in acquiring, developing and providing the equipment necessary to operate said landfill, which user's fees will be established by the City and County upon the recommendation of the WASTE MANAGEMENT ADMINISTERING BOARD. The user's fees now in effect at the time of the execution of this Agreement are \$.50 per cubic yard.

5. Term of Agreement.

The City and County obligate themselves to use said landfill and pay their share of user's fees over the useful life of the landfill, and this Agreement shall remain in full force and effect throughout the anticipated useful life of the landfill facility unless sooner terminated by mutual consent of both the City and County.

6. Distribution of Assets.

Upon the expiration or sooner termination of this Agreement, the disposition or distribution of any properties or monies acquired through the execution of this Agreement shall be on a prorata basis to the public agency using said facility in direct proportion to each party's contribution, whether by original cost, replacement costs, operational cost, user fees or other costs.

7. Management.

It is agreed that the operation of said landfill may be under the direct supervision of the WASTE MANAGEMENT ADMINISTERING BOARD; and Board being composed of a representative from each of several cities within Alachua County and a representative of the County and a representative of the University of Florida.

8. Other Participating Agencies.

It is anticipated and understood that a similar Agreement will be entered into between Alachua County and the University of Florida either by interlocal agreement or letter of intent.

9. Condition Precedent.

Prior to and as a condition precedent to its entry into force, this Interlocal Agreement shall be submitted to and approved by the Department of Legal Affairs of the State of Florida.

10. Filing.

This Agreement and any subsequent amendments hereto shall be filed with the Clerk of the Circuit Court of Alachua County, Florida, and with the Department of Community Affairs of the State of Florida.

IN WITNESS WHEREOF, the respective governmental bodies executing this Agreement has, in pursuance of due and legal action of their respective Board or Commission, caused these presents to be approved and executed by their under-signed officers the day and year first above written.

THE CITY OF GAINESVILLE,
A Municipal Corporation

By: _____
Mayor - Commissioner

ATTEST:

Clerk of the Commission

Seal

Alachua County,
A Political Subdivision
of the State of Florida

By: _____
Chairman

ATTEST:

Clerk

Seal

13.0 GLOSSARY

The terms used in the Solid Waste Management and Resource Recovery Program, and Chapter 17-7 F.A.C. shall have the special meaning as defined below unless the context clearly indicates otherwise.

"Abandoned Vehicles" are passenger automobiles, trucks, trailers, farm equipment, etc., that have no remaining useful life and are left unattended on public or private property.

"Agricultural Waste" means the solid waste that results from the rearing and slaughtering of animals and the processing of animal products, orchard and field crops which are stored, transported or disposed of as an unwanted waste material and which may be a potential pollution source.

"Alley Collection" means the picking up of solid waste from containers placed adjacent to or in an alley.

"Aquifer" means an underground, water-bearing geologic formation.

"Available Market" means any person, user or enterprise, willing to enter into a long-term contract or agreement to purchase materials or energy recovered from solid waste.

"Baling" means a method of reducing and restraining solid waste volume by mechanical compaction to achieve high density per unit volume to affect cost savings in transfer, hauling and disposal.

"Bulk Container" means a large container than can either be pulled or lifted onto a service vehicle mechanically or be mechanically emptied into a service vehicle.

"Bulky Wastes" means items whose large size or weight precludes or complicates their handling by normal collection, processing, or disposal methods.

"Cell" is a volume of solid waste compacted on an inclined plane and enclosed by a layer of earth.

"Collection" means the act of collecting solid waste at the place of waste generation by an approved collection agent (public or private).

"Commercial Establishment" means stores, offices, restaurants, warehouses and other non-manufacturing activities.

"Commercial Solid Waste" means all types of solid wastes generated by stores, offices, restaurants, warehouses and other non-manufacturing activities, and non-processing wastes such as office and packing wastes generated at industrial facilities.

"Compactor Collection Vehicle" means a vehicle with an enclosed body containing mechanical devices that convey solid waste into the main compartment of the body and compress it into a smaller volume of greater density.

"Composting" means a controlled process of degrading organic matter by microorganisms resulting in a humus material which is useful as a soil conditioner.

"Composting Facility" means a facility where organic matter is processed by natural or mechanical means to aid the microbial decomposition of the organic matter. Processing may include simple exposure resulting in natural decay or physically turning, windrowing, abrating or other mechanical reduction of the organic matter.

"Construction and Demolition Waste" means the waste building materials, packaging, and rubble resulting from construction, remodeling, repair, and demolition operations on pavements, houses, commercial buildings and other structures.

"Container Station" means a level, prepared area where non-stationary containers of 4 to 40 cubic yard capacity are located to receive solid wastes which are deposited by local residents.

"Council" means the Florida Resource Recovery Council (RRC) Chapter 403.710 F.S.

"County or Municipality" or any like term, shall include political subdivisions engaged in resource recovery and management.

"Curb Collection" means collection of solid waste placed adjacent to a street.

"Daily Cover" is a six (6) inch layer of compacted earth used to enclose a cell once each working day.

"Dead Animals" means animals that have died from any cause and which are left on public or private property without proper burial.

"Department" means Department of Environmental Regulation.

"Designated Areas" means those areas which are designated by the Resource Recovery Council to plan for resource recovery on the basis of population, waste generation and available markets.

"Dump" is a land disposal site at which solid waste is disposed of in a manner which does not protect the environment and is exposed to the elements, vectors and scavengers.

"Energy Recovery" means the conversion of solid waste into energy.

"Facility" means all processing equipment, buildings, and grounds at a specific site.

"Final Cover" is a layer of compacted earth two feet in depth applied to a completed landfill the top six (6) inches of which is loosely compacted to promote plant growth.

"Generation" means the act or process of producing solid waste.

"Ground Water" is subsurface water in the zone of saturation of the earth's crust. The top of this zone of saturation is commonly defined as the water table.

"Hazardous Wastes" are materials or combinations of materials which require special management techniques because of their acute and/or chronic effects on air and water quality; on fish, wildlife, or other biota; and on the health and welfare of the public. These materials include, but are not limited to, volatile, chemical, biological, explosive, flammable, radioactive, and toxic materials.

"Implementation Schedule" means a timetable for carrying out a local plan.

"Industrial Solid Waste" means the solid waste that results from industrial processes and manufacturing.

"Infectious Wastes" are those wastes resulting from the operation of medical clinics, hospitals, abattoirs, and other facilities producing waste which may consist of, but are not limited to, human and animal parts, contaminated bandages, pathological specimens, hypodermic needles, contaminated clothing, and surgical gloves.

"Institutional Solid Waste" means solid wastes originating from educational, health care, correctional and other such facilities.

"Intermediate Cover" is a layer of compacted earth one foot in depth applied to a partially completed landfill where final cover is not to be applied within one year of cell completion.

"Leachate" is a liquid that has percolated through solid waste and contains dissolved or suspended materials that may contaminate surface or underground waters used as sources of food, water supplies, recreation, etc.

"Lift" is a completed horizontal series of cells.

"Litter" means any post-consumer solid waste which is not deposited in an authorized storage, transfer, processing, or land disposal facility.

"Local Agency" shall have the same meaning as "Public Agency".

"Local Solid Waste Program" means a local resource recovery and management program as described in Chapter 17-7.23 F.A.C., which includes both a plan and an implementation schedule.

"Materials Recovery" means any manual or mechanical process in which one or more of the various components in solid waste are separated, concentrated, and reused.

"Milled Refuse" is refuse that has been mechanically ground, shredded or pulverized.

"Monitoring Wells" are strategically located shallow and deep wells from which water samples are drawn for analysis of possible contaminants and from which direction of ground water flow is determined.

"Non-Combustible Refuse" means refuse materials that are unburnable at ordinary incinerator temperatures (1300 to 2000 degrees F).

"Person" means any and all persons, natural or artificial, including any individual, firm, or association, any municipal or private corporation organized or existing under the laws of Florida or any other state, and any county or governmental agency of this state or the federal government.

"pH" means negative logarithm of the hydrogen ion concentration; a measure of acidity and alkalinity.

"Plan" means reports and drawings, including a narrative operating description, prepared to describe a facility or system and its proposed operation.

"Planning Area" means the area defined by a local agency or agencies for resource recovery and management planning.

"Postcollection Recovery" means manual or mechanical separation and recovery of materials from mixed municipal solid waste upon delivery at a resource recovery and management facility.

"Post-Consumer Waste" means a material or product that has served its intended use and has been discarded for disposal or recovery after passing through the hands of a final consumer.

"Precollection Recovery" means recovery of materials before they become mixed in a collection vehicle.

"Program" means the Resource Recovery and Management Program described in Chapter 403.705 and 403.706 F.S.

"Promiscuous Dump" means an unauthorized site where indiscriminate deposits of solid waste are made by unknown persons.

"Public Agency" means a political subdivision, agency or officer of this state or of any state of the United States, including, but not limited to, state government, county, city, school district, single and multipurpose special district, single and multipurpose public authority, metropolitan or consolidated government, an independently elected county officer, any agency of the United States government, and any similar entity of any other state of the United States. Chapter 163.03(b) F.S.

"Putrescible Wastes" are materials capable of decomposition, causing environmental nuisances and/or obnoxious odors.

"Pyrolysis" means the chemical decomposition of material by heat in the absence of air.

"Recoverable Resources" means materials that still have useful physical or chemical properties after serving their original purpose and can, therefore, be reused or recycled for the same or other purposes.

"Recycled Material" means a material that is utilized in place of a primary, raw or virgin material in manufacturing a product.

"Recycling" means the reuse of solid waste in manufacture, agriculture, power production, or other process.

"Regional Authority" means one or more public agencies joining together by inter-local agreements for a stated period of time, to assume the responsibility for resource recovery and management.

"Residential Solid Waste" means the garbage, rubbish, trash, and other solid waste resulting from the normal activities of households.

"Residue" means material that remains after useable gases, liquids or solids have been removed.

"Resource Recovery and Management Facility" means any solid waste disposal area, volume reduction plant, or other facility the purpose of which is resource recovery or the disposal, recycling, processing, or storage of solid waste.

"Responsible Agency" means the organizational element that has the legal duty to ensure compliance with these guidelines.

"Runoff" means the portion of precipitation or applied water that drains from an area as surface flow.

"Rural Container Collection System" means a collection system which involves mechanically serviceable containers, usually from 4 to 40 cubic yards capacity, strategically located throughout an area that are emptied twice each week and their contents delivered to a transfer station, solid waste processing or disposal facility.

"Salvaging" means the controlled removal of waste material for utilization.

"Sanitary Landfill" is a disposal facility employing an engineered method of disposing of solid waste on land in a manner which minimizes environmental hazards by spreading the solid wastes in thin layers, compacting the solid wastes to the smallest practical volume, and applying cover material once each working day.

"Satellite Vehicle" means a small collection vehicle that transfers its load into a larger vehicle operating in conjunction with it.

"Scavenging" means the uncontrolled and unauthorized removal of materials at any point in the solid waste management system.

"Separate Collection" means the collection of recyclable materials which have been separated at the point of generation and keeping those materials separate from other collected solid waste in separate compartments of a single collection vehicle or through the use of separate collection vehicles.

"Sewage Treatment Residues" means coarse screenings, grit, or sludge from wastewater treatment units.

"Shredding" means a process of reducing the particle size of solid waste through use of grinding, shredding, milling or rasping machines.

"Sludge" means a semi-liquid sediment.

"Solid Waste" means garbage, rubbish, refuse, and other discarded solid or semisolid materials resulting from domestic, industrial, commercial, agricultural, and governmental operations, but does not include solids or dissolved material in domestic sewage or other significant pollutants in water resources such as silt, dissolved or suspended solids in industrial wastewater effluents, dissolved materials in irrigation return flows, or other common water pollutants.

"Solid Waste Management" means a plan for effectively controlling the generation, storage, collection, transportation, processing and reuse, conversion or disposal of solid waste in a safe, sanitary, aesthetically acceptable, environmentally sound and economical manner. It includes all administrative, financial, legal, environmental and planning functions as well as the operational aspects of solid waste handling, disposal and resource recovery.

"Source Separation" means the setting aside of recyclable waste materials at their point of generation by the generator.

"Special Wastes" means those wastes that require extraordinary management. They include, but are not limited to, abandoned automobiles, white goods, used tires, waste oil, sludges, dead animals, agricultural and industrial wastes.

"Specification" means a clear and accurate description of the technical requirement for materials, products or services, which specifies the minimum requirement for quality and construction of materials and equipment necessary for an acceptable product. In general, specifications are in the form of written descriptions, drawings, prints, commercial designations, industry standards, and other descriptive references.

"Storage" means the interim containment of solid waste, in an approved manner, after generation and prior to collection for ultimate recovery or disposal.

"Ton" means a short ton, 2000 pounds.

"Transfer Station" means a facility where solid waste from several relatively small vehicles is placed into one relatively large vehicle before being transferred to a solid waste processing or disposal facility.

"Treatment" means the process of altering the character, physical or chemical condition of the waste to prevent pollution of water, air or soil to safeguard the public health or enable the waste to be recycled.

"Vector" means a carrier, usually an arthropod, that is capable of transmitting a pathogen from one organism to another.

"Virgin Material" means a raw material used in manufacturing that has been mined or harvested and has not as yet become a product.

"Volume Reduction Plant" includes, but is not limited to, incinerators, pulverizers, compactors, shredding and baling plants, transfer stations, composting plants and other plants which accept and process solid waste for recycling or disposal.

"Waste Oil" means all types of waste oils, including waste automotive lubricants, industrial waste oils, and others that may be a potential pollution source.

"White Goods" are inoperative and discarded refrigerators, ranges, washers, water heaters and other similar domestic and commercial appliances.

"Working Face" is that portion of a sanitary landfill where waste is discharged, spread and compacted prior to placement of daily cover.

"Yard Trash" means vegetative matter resulting from landscaping maintenance such as tree and shrub trimmings, grass clippings and palm fronds.



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